

# Compressed Air

NOVEMBER 1957

## *Magazine*

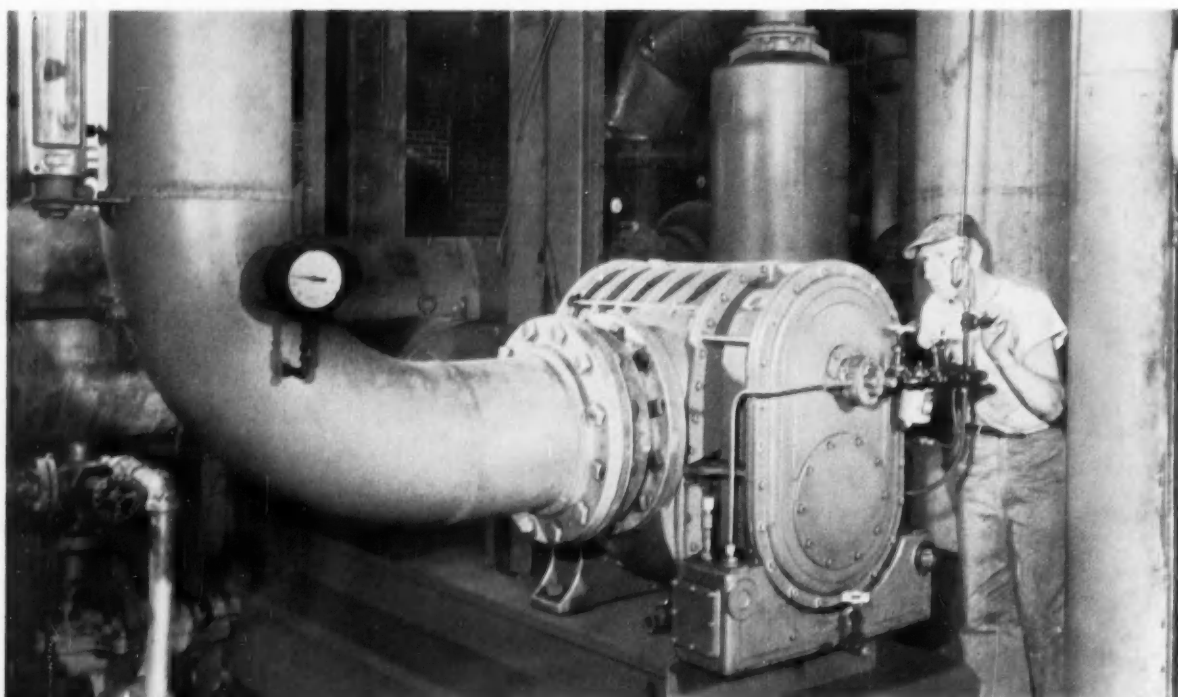


THROUGH THE LOCKS  
IN WELLAND CANAL  
Giant lockers push through  
Welland's double-flight  
locks at Thorold  
(SEE INDEX, PAGE AND PAGE 228)

VOLUME 62 • NUMBER 11

NEW YORK • LONDON

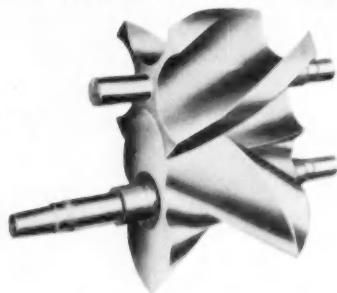
**Most compact compressor of its type . . .**



AXI-COMPRESSOR in an industrial plant

Use the  
***Axi-compressor\****

*for pressure and vacuum . . .  
for air, gases, vapors*



Rotors of Axi-Compressor

If you are looking for a compact, efficient source of pressure or vacuum, investigate AXI-COMPRESSORS: they provide greater output per pound of unit. AXI-COMPRESSORS may be operated efficiently over a wide range, with low power consumption.

Rotors are of cycloidal form, screw type. They operate with clearances of a few thousands of an inch, but never touch . . . there's no need for internal lubrication.

Operating advantages of this axial-flow, positive-displacement unit includes the following:

1. Compact, rugged construction
2. Smooth, shockless flow
3. No metal-to-metal contact in compression chamber
4. Operating speeds that permit direct-connected drivers in many cases
5. Oil-free delivery
6. Good efficiency over wide range

For complete information on the AXI-COMPRESSOR line for pressures from 25-inch vacuum to 15 psi, capacities from 100 cfm to 15,000 cfm . . . contact your Ingersoll-Rand compressor specialist. Performance curves available in Bulletin 11,001 . . . write for it.

*\*Axi-compressor*

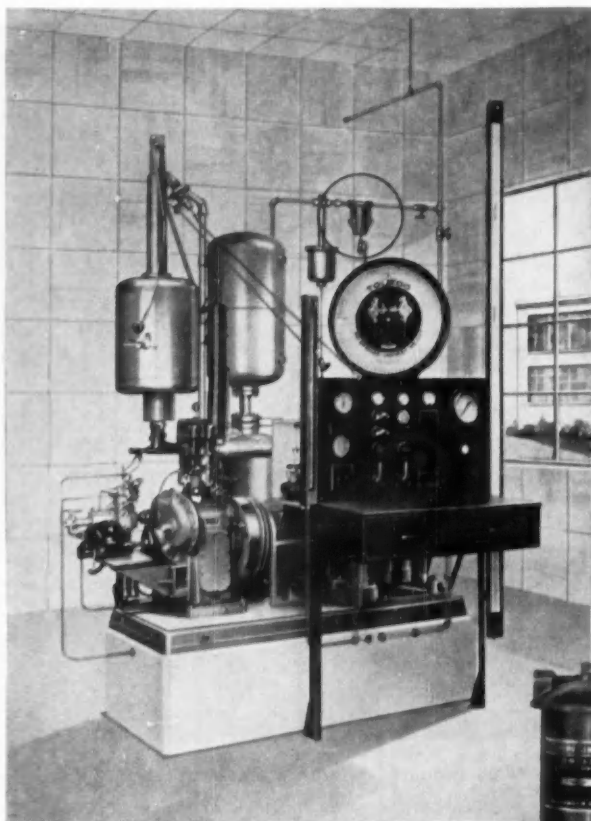
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PUMPS • CENTRIFUGAL & RECIPROCATING COMPRESSORS • DIESEL ENGINES • AIR & ELECTRIC TOOLS • TURBO BLOWERS • STEAM CONDENSERS

Circle 1A on reply card



Waukesha Motors' ASTM unit for determining knock characteristics by the supercharge method—ASTM D-909. Staynew filter, Model CPHB-01 (circled and inset), has been used on Waukesha-built, knock-rating engines since inception of the test method in 1942.

# STAYNEW FILTERS

choice  
on

## Knock-Test Engines

The knock-rating engine built by the Waukesha Motor Company, used to determine octane values of aviation-type gasolines in industry, refineries, and research laboratories, is equipped with a Staynew filter, Model CPHB-01.

The CPHB-01 is a pressure-type filter designed for installation in horizontal pipelines handling air or other gases. Its maximum working pressure is 125 psig, an effective surplus over the 100 psig used in the Waukesha-built ASTM supercharge unit.

This filter effectively removes dust, moisture, dirt, pipe scale, and other foreign matter, and the standard filtering medium will remove dust particles as small as three or four microns (0.000156") in size. Special

media are available for finer filtration and for temperatures as high as 1300° F. Models of stainless steel, bronze, or other alloys will handle corrosive gases.

Clean air is essential here because, to secure proper results, the engine must be maintained in topnotch condition. Dirty air will upset results because of the dirt's adverse effects on valves, pistons, etc.

Staynew filters have been used on Waukesha-built supercharge knock-testing engines ever since their inception in 1942. Only minimum maintenance is required.

Whatever your filtering problem, there's a Dollinger representative nearby ready to help solve it. Write today, The Dollinger Corporation, 7 Centre Park, Rochester 3, New York.

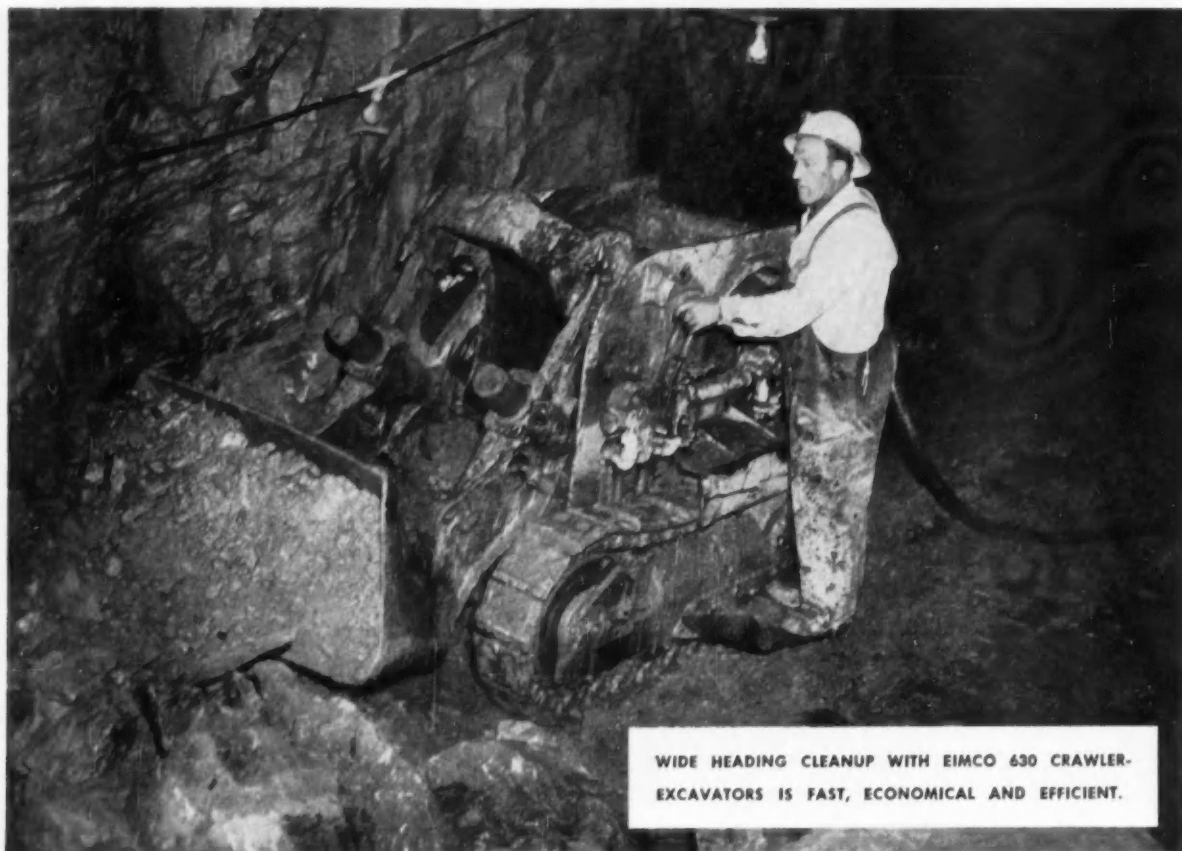


**STAYNEW**

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## REDUCE THE COST SQUEEZE WITH EIMCO 630 TRACTOR-EXCAVATORS

With the "cost squeeze" tightening . . . you can use production savings offered by the Eimco 630 Tractor-Excavator to profitable advantage.

The 630 provides you features that pay-off in more production, operator efficiency and safety. Ruggedly constructed to withstand the severest operating conditions, the 630 insures against excessive down-time and costly maintenance.

Easy, convenient controls make the Eimco

respond instantly to the operator's demands. In tough digging (with independent track reversal) he can maneuver the Eimco fast and sharp — from side to side — to cram the bucket without making a new approach. He can move the loaded bucket into overhead dump position while traveling.

Bulletin L-1039 will acquaint you with more Eimco 630 details. An Eimco Engineer will provide you with reliable production information.

**THE EIMCO CORPORATION**  
Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

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# Compressed Air Magazine

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PHOTO, NATIONAL FILM BOARD (CANADA)

## ON THE COVER

CANADA'S famed Welland Canal surpasses the cataracts of Niagara, overcoming a drop of 327 feet and permitting ships to travel between lakes Erie and Ontario. The present canal was officially opened in June 1931, and now is being deepened as part of Canada's share of the St. Lawrence Seaway. The cover picture shows the lakers *Oser* (foreground), and *Sure Water* passing through the double-flight locks at Thorold, Ont. Our lead article this month tells something about the work now underway in the Welland Canal.

## FEATURE ARTICLES

### Page 328 Deepening the Welland Canal—*J. P. Smallwood*

As a portion of the Canadian Government's cooperation in the construction of the St. Lawrence Seaway, the Welland Canal is being deepened. It cuts through the Niagara Peninsula from Port Weller to Port Colborne, Ont., and is said to rank in importance to the "Soo," Suez and Panama passages. The work is being handled by several contractors, and their efforts, as well as some facts about the commercial value of the canal and some of its early history are described.

### 335 Specialist in Air Devices—*C. H. Vivian*

All personnel concerned with compressed air applications have an interest in lubrication devices for their systems. C.A. Norgren Co., has long been one of the world's leaders in the manufacture of these items. The Denver, Colo., facility, some of its products and how Carl A. Norgren began his venture are told about in our second article.

### 339 Testing Jet Engine Components—*R. W. Sapora*

At Evendale, Ohio, General Electric Company's test facilities aid in the production of better, more powerful jet engines for airplanes and other craft as yet unbuilt. The huge air supply required for this work is regarded as the heart of its applied research activity.

### 342 Air Hoists Permit Precision Control

### 346 Old Streetcars Never Die—*Carey Holbrook*

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G. W. Morrison, *Publisher*

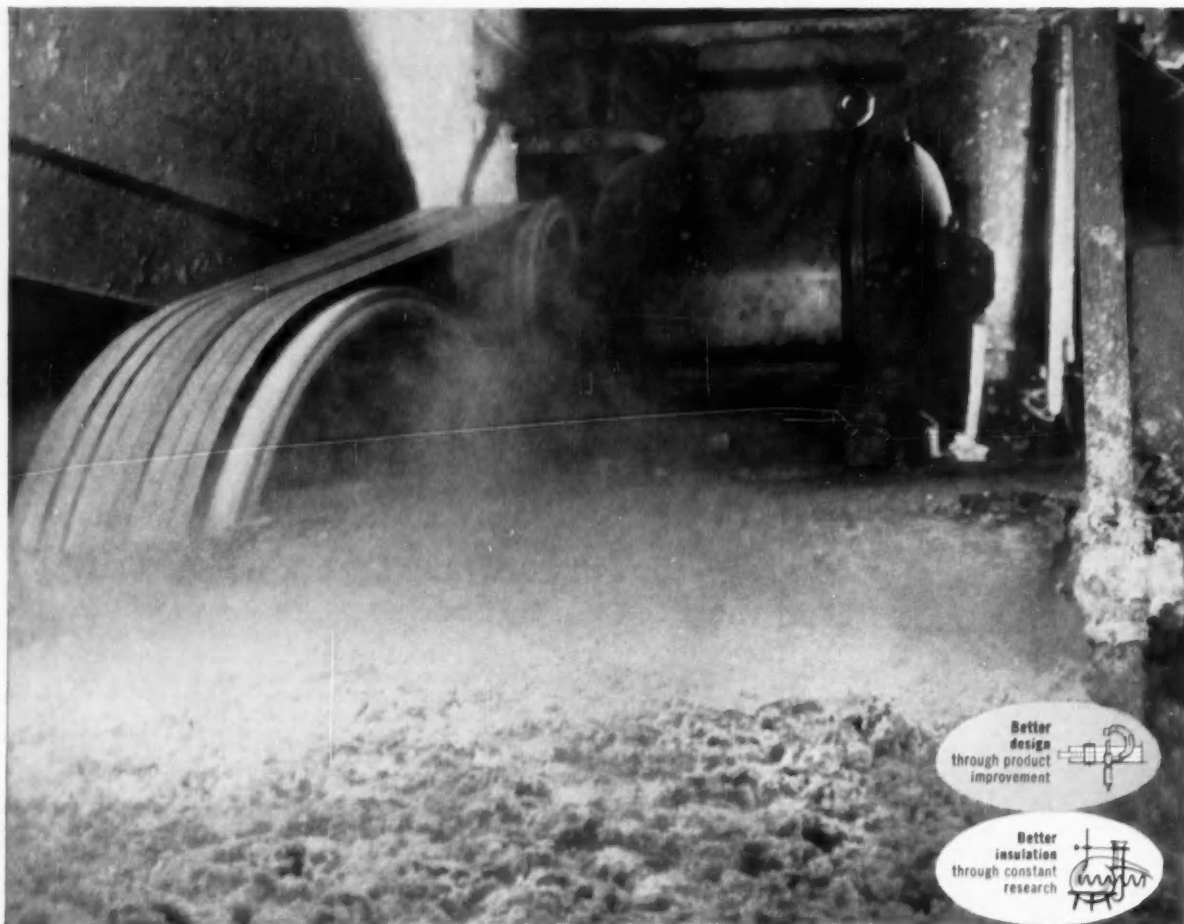
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Better  
design  
through product  
improvement

Better  
insulation  
through constant  
research



## Moisture-laden hot-spot calls for some cool figuring!

**Superior design of Louis Allis  
electric motors pays off under severe heat-humidity conditions**

This paddle-agitator drive gets a steady bath of searing hot vapors from the trough below. Yet, the Louis Allis motor has given continuous and reliable service. Here are the special design techniques that make this possible:

*Special attention to insulation*—Louis Allis sponsors continuous research into new insulating materials. One example: Louis Allis engineers were first to combine Gilsonite with phenolics and alkyds. The result is a varnish with the highest degree of moisture, acid, and alkali resistance — extra-long life for all motor uses whatever your design problem.

*Special care in manufacturing*—Quality control of

all materials . . . careful inspection . . . rigid test . . . all of these add up to the highest quality standards in the industry to assure you of continuous fine performance, dependability under any condition.

These and other Louis Allis extras—such as locked bearings for longer wear, positive lead identification for easier maintenance, and dynamically balanced rotor for quieter operation — could be the answer to your special design problems.

The complete story is in our Bulletin 1700. May we send it to you? Contact your nearby Louis Allis District Office or write The Louis Allis Company, 437 East Stewart Street, Milwaukee 1, Wisconsin.

### LOUIS ALLIS

MANUFACTURER OF ELECTRIC MOTORS AND ADJUSTABLE-SPEED DRIVES

# how to get the most out of HOLLOW DRILL STEEL



To bring you the best drill rods possible, manufacturers spend many thousands of dollars each year in development and testing. Crucible, for example, put more than half a hundred different alloys through their paces before CA DOUBLE DIAMOND and 4E Alloy Hollow Drill Rods proved the answer to lower cost drilling.

But to get the most out of modern drill steels, you've got to *maintain* their fine quality *after they reach your shop*.

## The Answer is Quality Control

Unintentional abuse of drill steel by improper forging, machining, heat treating and other shop operations, produces a rod that is bound to give poor performance.

That's why full time supervision on operations such as these can mean longer drill life on the job:

1. Check heat treating process. Overlap heats for proper time.
2. Check furnace and forging temperatures.
3. Check annealing process to insure correct hardness.
4. Check Rockwell hardness of shanks and thread ends.
5. Check fit of bits on newly threaded rods.
6. Check location and severity of metallurgical notch.
7. Examine all rods returned from the job and determine reason for failure.

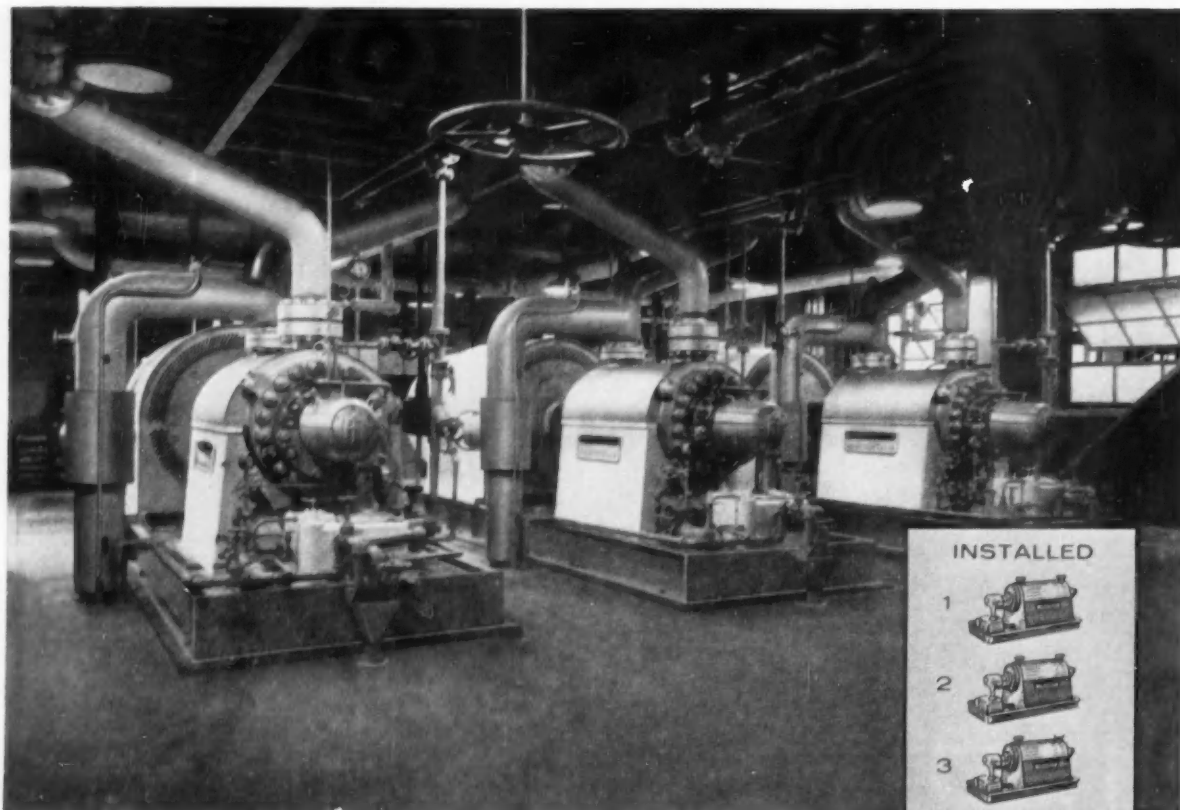
Shop control of this type actually saves money by eliminating many rod failures on the job. Personnel will be enthusiastic in reporting improved rod performance, and you'll be getting lower cost per foot of hole drilled.

Your nearby Crucible representative will be glad to supply helpful information on other phases of drill rod care and operation — or arrange for *prompt deliveries* of hollow drill rods in the sizes, grades, and types you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

# CRUCIBLE

first name in special purpose steels

# Crucible Steel Company of America



## Twelve more reasons why CHTA pumps are INDUSTRY'S FIRST CHOICE for high-pressure boiler-feed service

**T**HE three Ingersoll-Rand 5-stage CHTA boiler-feed pumps shown above are installed in a large southwestern industrial power plant — each unit handling 1150 gpm at 3775 ft discharge head. Three other 6-stage CHTA units are installed in the same plant, and six more are now on order.

Each of these 12 units is another vote of confidence in the *performance* and *dependability* of CHTA pumps. In case after case, repeat orders from satisfied users make them the most widely used pumps for high-pressure boiler-feed service in the 1000 to 6500 psi range.

The Unit-Type Rotor Assembly—a distinctive I-R feature—contributes to high sustained efficiency, maximum strength, easy maintenance and widest possible interchangeability of parts throughout the entire CHTA line. The many unique features and advantages of these advanced-design pumps are fully illustrated and described in Bulletin No. 7211.

Whenever you have a high-pressure boiler-feed problem, your Ingersoll-Rand representative will welcome the opportunity to help you work out the problem to *your* best advantage.



# Ingersoll-Rand

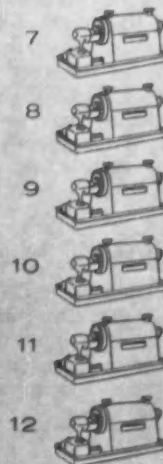
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11 Broadway, New York 4, N. Y.

### INSTALLED



### ON ORDER



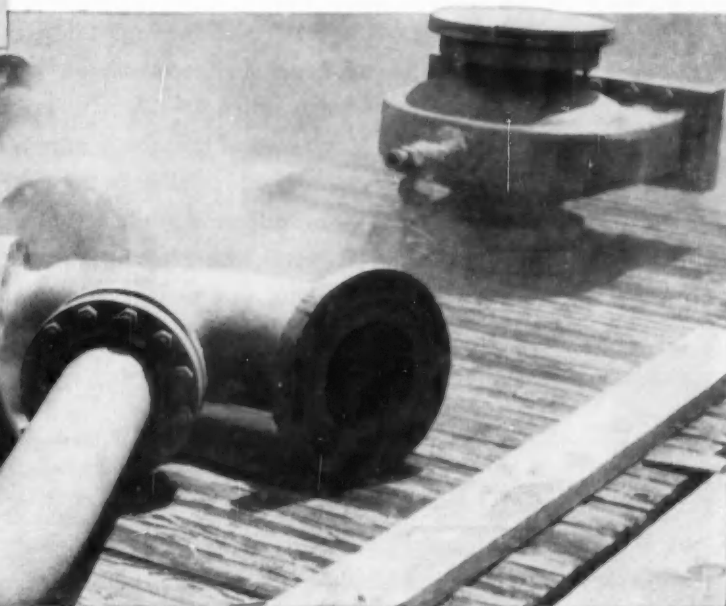
ALL FOR THIS  
ONE  
POWER PLANT

COMPRESSORS • GAS & DIESEL ENGINES • PUMPS • AIR & ELECTRIC TOOLS • CONDENSERS • VACUUM EQUIPMENT • ROCK DRILLS



# ***BLAST!***

**... hundreds of hours longer  
with NORBIDE®  
Pressure Blast Nozzles**



**NORTON®**  
**BORON CARBIDE**

*Making better products...  
to make your products better*

**NORTON PRODUCTS**  
Refractories • Abrasives  
Grinding Wheels • Grinding Machines  
BEHR-MANNING DIVISION  
Coated Abrasives • Sharpening Stones  
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NORBIDE Pressure Blast Nozzles outwear any other type . . . 750 hours using silica sand . . . 1500 hours using steel shot or grit . . . air consumption decreased from 10 to 20 percent . . . stream contour and abrasive velocity maintained. For you, this means more service per dollar. For full details on cost-cutting NORBIDE Nozzles, write for your free copy of Form 543.

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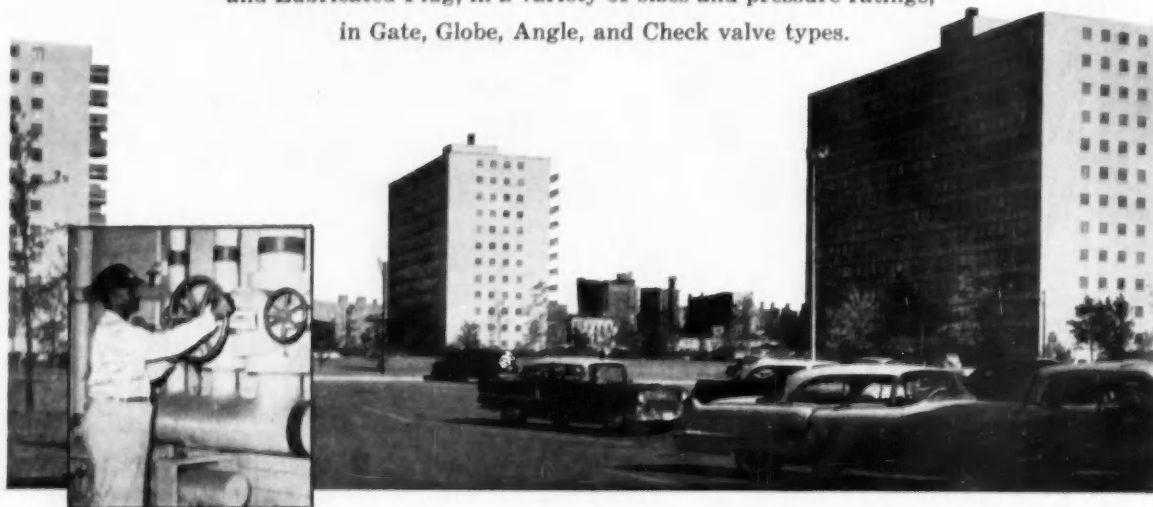
**NORBIDE . . . *The Longest Nozzle Life You Can Buy***



Carefully selected  
Walworth valves and fittings  
serve ultra-modern

# Lake Meadows development

Chicago's new 100-acre development, to house about 2000 families, makes the facilities of its streamlined shopping center available to additional thousands in the surrounding area. Quality is the keynote throughout the construction of Lake Meadows and literally hundreds of Walworth Valves and Fittings have been specified and installed in the vital plumbing, heating, ventilating and air conditioning systems. Valve requirements have been so broad that almost all of Walworth's complete lines are represented—Steel, Iron, Bronze and Lubricated Plug, in a variety of sizes and pressure ratings, in Gate, Globe, Angle, and Check valve types.



Cable Maxwell, Stationary Engineer, operating a Walworth Iron Gate Valve on main steam lines to various buildings at Lake Meadows.

OWNER: New York Life Insurance Company  
ARCHITECT: Skidmore, Owings & Merrill  
BUILDER: Turner Construction Company  
CONTRACTOR: Economy Plumbing and Heating Company

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## In California and the World Over Rock Really Rolls with Bucyrus-Eries Loading

Granite-heaped hauling units flow steadily from beneath the dipper of this 6-yd. Bucyrus-Erie 150-B shovel—one of two such units being used by Morrison-Walsh-Perini in construction of the Wishon Dam for the Pacific Gas and Electric Company.

This \$12-million rock-filled dam will be located on the north fork of the Kings River, 88 miles east of Fresno, California. It will require excavation of 3½ million cubic yards of granite and impervious material.

This long, tough job, scheduled for completion in November, 1958, demands excavators that will maintain consistent, high production month after month. Bucyrus-Eries have the design and manufacturing extras to give that kind of performance in the toughest of digging. Outstanding front-end design, for instance, with tubular dipper handle, provides extraordinary strength without extra weight. Freedom of the handle to rotate in the saddle block eliminates torsional stresses during digging.

The field-proved quality built into Bucyrus-Erie machines makes them the choice of the men who handle the big jobs like this Wishon Dam project. Write for full information on the Bucyrus-Erie 110-B, 150-B or 190-B heavy-duty excavators.

131LS7C



# BUCYRUS-ERIE COMPANY

SOUTH MILWAUKEE, WISCONSIN



AT PENN VENTILATOR COMPANY

## DIEHL motors increase product dependability

Operating dependability is an inherent feature of the power-roof ventilators made by Penn Ventilator Company, Philadelphia, Pa. Usually, these ventilating units are installed in locations completely exposed to the elements and relatively inaccessible for regular servicing. Failure in operation, however, could halt an important manufacturing operation or even cause complete plant shut-down. Hence, every detail in the design and construction of Penn Ventilators is considered with a view to the assurance of uninterrupted operation for long periods of time with a minimum of maintenance.

This is one of the reasons why Penn Ventilator Company has consistently selected DIEHL motors for its equipment. James T. Ellington, Penn Director of Purchases says: "We can't gamble with an inferior unit—a reliable motor is a necessity! DIEHL motors are trouble-free and well suited to all our requirements."

Here is another example of how DIEHL has cooperated with a progressive manufacturer to build a product of highest quality and proved reliability. With almost three quarters of a century of experience in the design and manufacture of motors, DIEHL is well equipped to help you solve your motor problems. We'll work closely with you to provide the right motor—at the right time—at the right price.

### DIEHL MANUFACTURING COMPANY

Electrical Division of  
THE SINGER MANUFACTURING COMPANY  
Finders Plant, SOMERVILLE, N. J.



- ☐ Please send me Consolidated Motor Catalog and Price List  
No. CA-11 3540
- ☐ Please have a DIEHL representative call

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## Mining Gold in the Black Hills

That's Bethlehem Hollow Drill Steel biting into hard, tough pre-Cambrian schist in the Homestake Mine at Lead, South Dakota—the largest gold mine in the western hemisphere.

The Homestake Mine, operated by Homestake Mining Company, has been active since 1877. It is now about 5600 ft deep, and has 25 working levels. Because of the hardness of the rock, drilling is extremely difficult. The cut and fill method is employed, with rock tailings used for fill. Bethlehem Hollow Drill Steel, fitted with carbide-insert bits on  $\frac{7}{8}$ -in. hexagon rods, is widely used throughout the workings. It's been giving an excellent account of itself, too. Reconditioning is done top-side, in Homestake's modern shop.

Bethlehem Hollow Drill is economical for all

kinds of rock drilling jobs because it is rolled from fatigue-resistant steel, and has a uniform hole, centrally located in the bar. It also has a wide quenching range. Moreover, it is easy steel to heat-treat for the proper balance of toughness and wear-resistance, making possible long-wearing threads and strong shanks.

Bethlehem Hollow Drill Steel comes in Carbon and Ultra-Alloy grades in rounds, hexagons and quarter-octagons. It is regularly furnished in lengths of from 18 ft to 27 ft, though longer lengths can also be supplied. Specify Bethlehem Hollow the next time you order drill steel.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

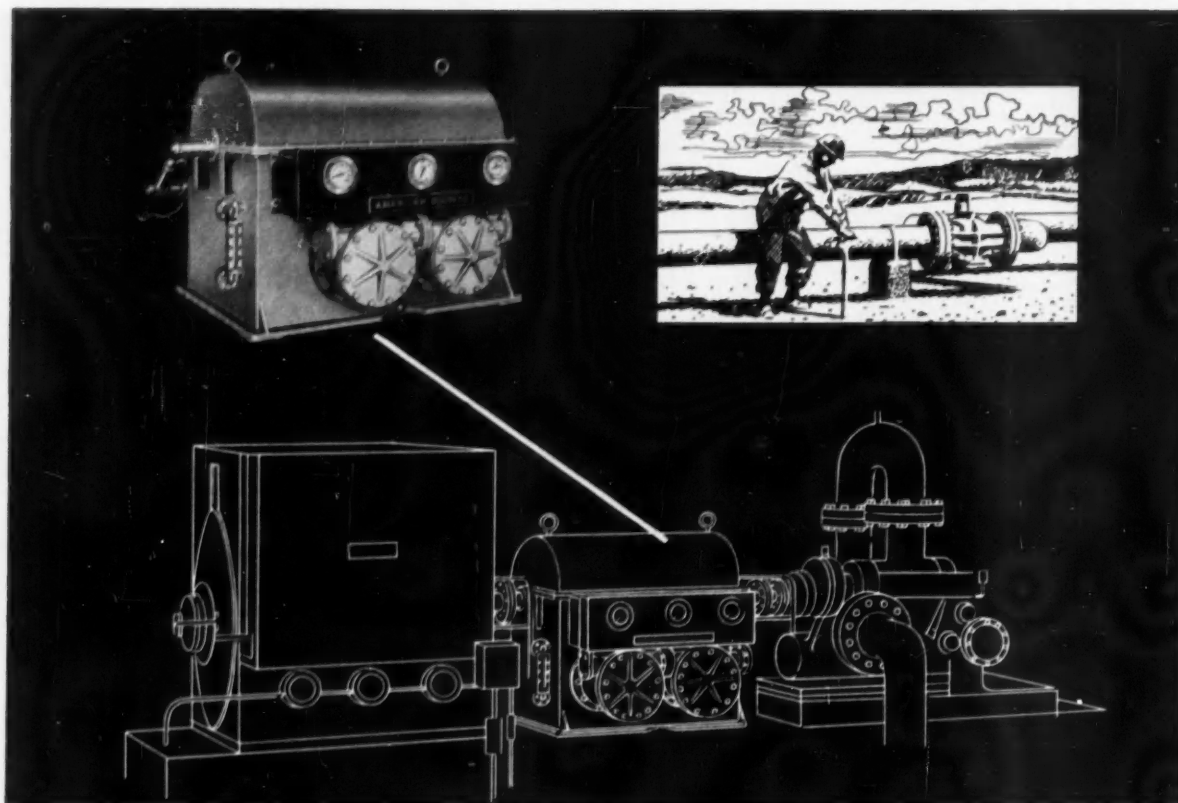
On the Pacific Coast Bethlehem products are sold by  
Bethlehem Pacific Coast Steel Corporation  
Export Distributor: Bethlehem Steel Export Corporation

# BETHLEHEM HOLLOW DRILL STEEL

**CARBON AND  
ULTRA-ALLOY**







Class 6 Type VS Gýrol Fluid Drive, 250 hp to 12,000 hp, speeds to 3,600 rpm.

## How to get more through-put per kw consumed at pipeline pumping stations

You save power dollars in pipeline pumping stations with American Blower Gýrol Fluid Drives. Used with standard, single-speed induction motors, the stepless, adjustable-speed Gýrol units control pump flow and pressure to give the desired output at the lowest power consumption.

For many years, the dependable Gýrol Fluid Drive has satisfied the automation requirements of the power plant industry for driving centrifugal boiler-feed pumps and fans. Now, the same reliable Gýrol Fluid Drive is providing the ideal means of remote-controlled power transmission for the centrifugal pumps in unattended pipeline pumping stations.

Whether you're pumping a single product or multiple products of various densities, here's how

you benefit with the Gýrol Fluid Drive:

- Lower demand charges
- Power savings by adjustable pump speed
- No-load motor starting
- Wide range of pump control, permitting complete flexibility whether one or several products are being pumped
- The use of standard induction motors and Gýrol Fluid Drive to provide a safe, dependable power combination

Call your American Blower branch office for full information; or write: American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

### AMERICAN BLOWER

Division of **AMERICAN-Standard**

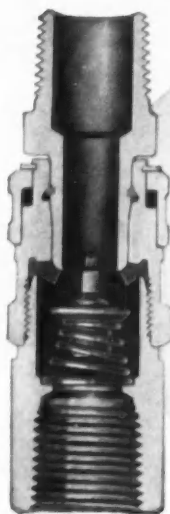
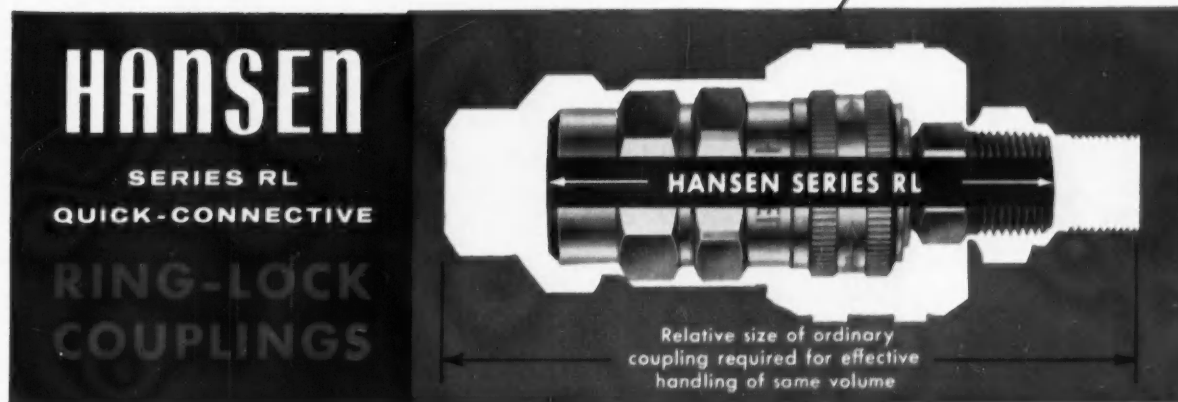




***Smaller!***  
***Lighter!***

HANSEN SERIES RL  
\* \* \*  
EFFECTIVELY HANDLES  
MORE VOLUME THAN ANY  
OTHER COUPLING OF  
EQUAL DIMENSIONS

HANDLES ANY  
JOB WITH FITTINGS  
FROM  $\frac{3}{8}$ " TO  $\frac{1}{2}$ "  
FROM THE AIR  
LINE TO THE  
AIR TOOL



Cutaway view of Hansen Series RL Coupling. Note simplified construction with minimum number of parts. Locking ring in Socket enters groove in Plug when Coupling is connected, insures tight fit — provides positive lock. Machined from solid bar stock, Plug is hardened and rust-proofed. Sockets with aluminum bodies available for use with small hand-operated air tools.

Hansen Series RL One-Way Shut-Off Couplings will handle any job in your shop using  $\frac{3}{8}$ " to  $\frac{1}{2}$ " connections — from the air line to the air tool. All Hansen Series 2-RL Sockets and Plugs are interchangeable with each other. Likewise all Sockets and Plugs of the slightly larger, greater capacity Series 3-RL are similarly interchangeable with each other.

Consequently, by standardizing on either Hansen Series 2-RL or Series 3-RL Couplings, you eliminate any need for various size couplings in your hook-up — make it easy to keep stock of parts in balance — and hold inventories to a minimum.

Locking ring provides positive lock and assures tight fit. Equipped with automatic sleeve lock.

*Two-Way Shut-Off and Straight-Through Couplings also available.*

WRITE FOR CATALOG

SINCE 1915



QUICK-CONNECTIVE FLUID LINE COUPLINGS

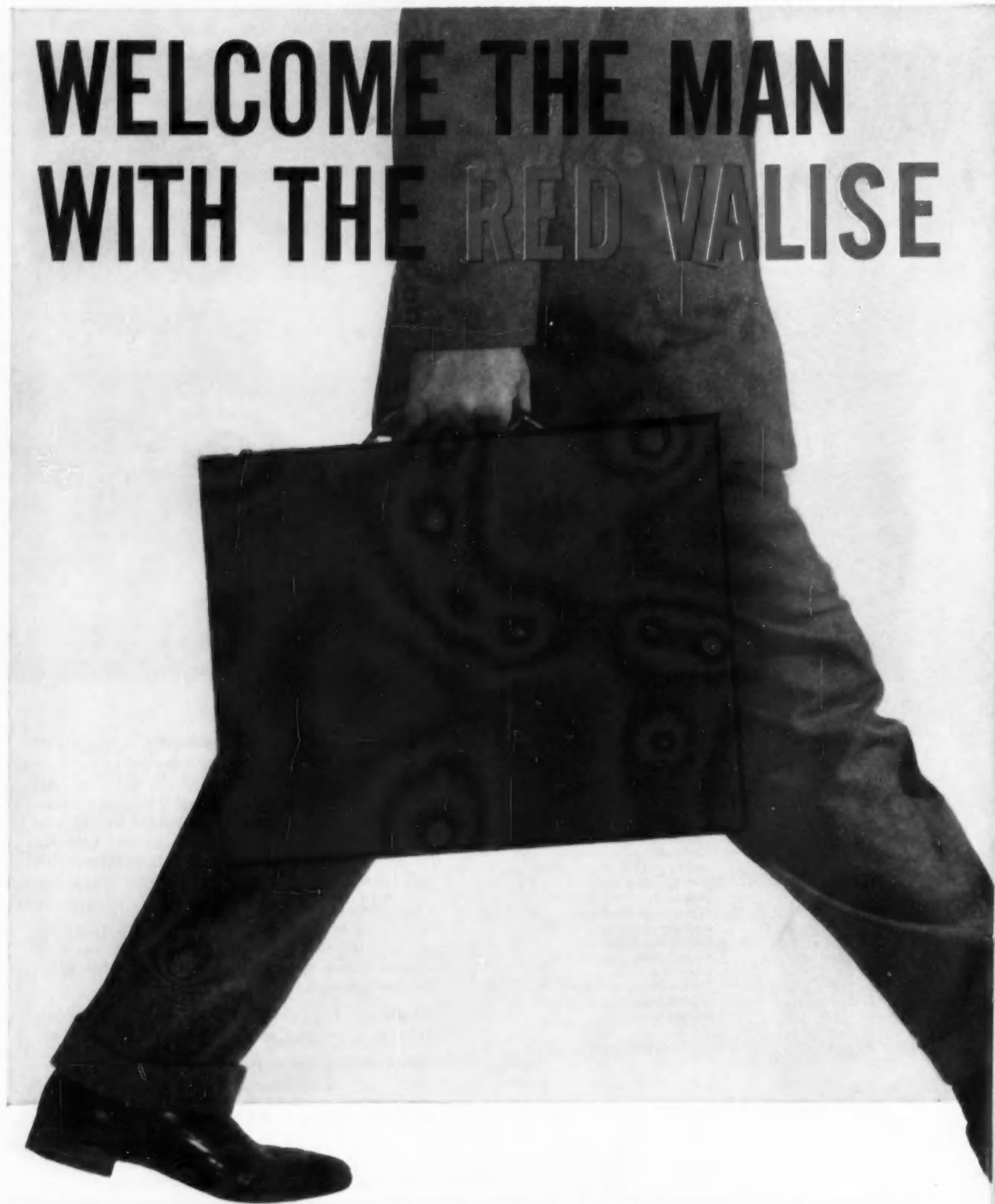
**THE HANSEN**

**MANUFACTURING COMPANY**

4031 WEST 150th STREET

CLEVELAND 11, OHIO

# WELCOME THE MAN WITH THE RED VALISE



**HERCULES**

## BLASTING CAPS

*Partners in Dependability with Hercules® Explosives*

# He can show you why Hercules sets the pace in Blasting Caps

Whatever you need in a blasting cap, Hercules has it—And the Hercules representative can show you an actual dummy sample from this "full line" kit. The Man with the Red Valise will be calling on you soon—if he hasn't already—and when he does you'll learn why Hercules is a recognized leader in blasting cap development.

Look at this Hercules lineup:

**Electric Blasting Caps**—Manufactured in two strengths with plastic-coated copper leg wires available in lengths from 4 to 250 feet.

**Waterproof Electric Blasting Caps**—Designed to withstand high water pressure.

**No Vent\* Delay Caps**—One-piece, all-metal shell. No Vent helps prevent misfire in wet work. Available in delay periods from "0" to "15". An exclusive Hercules development.

**No Vent\* Short-Period Delay**—Similar in construction to

No Vent cap but in 27 delay periods from 25 milliseconds to 2950 milliseconds.

**Electric Squibs**—Special firing devices for use with black blasting or pellet powder where electricity is employed.

**Special Packings**—All-electric blasting caps may be obtained packed on cardboard spools for easier handling. Primatube®, a rigid cardboard tube available for some types of caps, makes a primer when the tube is fitted over a dynamite cartridge.

**Seismic Aids**—Vibrocap® SR has been designed especially for seismic prospecting; it registers the "time-break" accurately throughout the entire range of low and high firing currents. Titan® Booster 20, a special booster detonating device for use with regular Hercules® Electric Blasting Cap or Vibrocap® SR, is also available.

You name it and the Man with the Red Valise will show it to you.

## HERCULES CAPS FEATURE:

**Dependable Fire**—Special alloy is used as the bridge wire in the firing element of Hercules Electric Blasting Caps. Wire is noncorrosive.

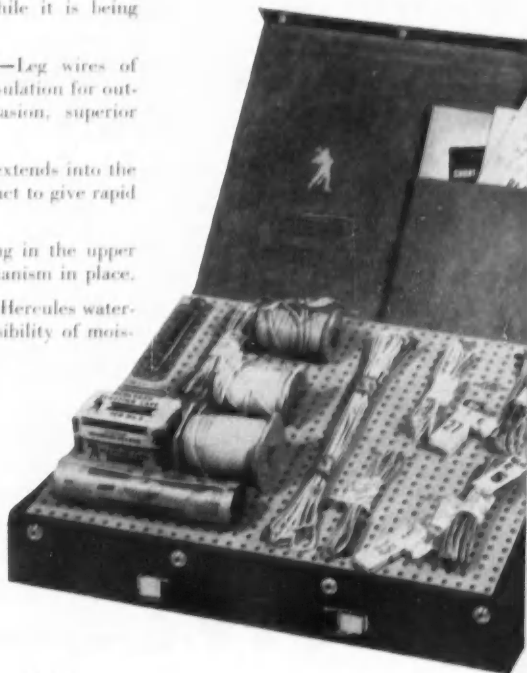
**Engineered Shell**—Bronze shell of a Hercules cap goes through fifteen separate operations while it is being expertly shaped.

**Tough, High Dielectric Insulation**—Leg wires of Hercules caps are coated with plastic insulation for outstanding toughness, resistance to abrasion, superior dielectric qualities.

**Double-Packed Wallop**—Bridge wire extends into the priming charge and makes positive contact to give rapid ignition.

**Securely Anchored**—A cast sulfur plug in the upper part of shell anchors entire firing mechanism in place.

**Watertight Waterproofing**—A special Hercules waterproofing formulation minimizes the possibility of moisture or dampness penetration.



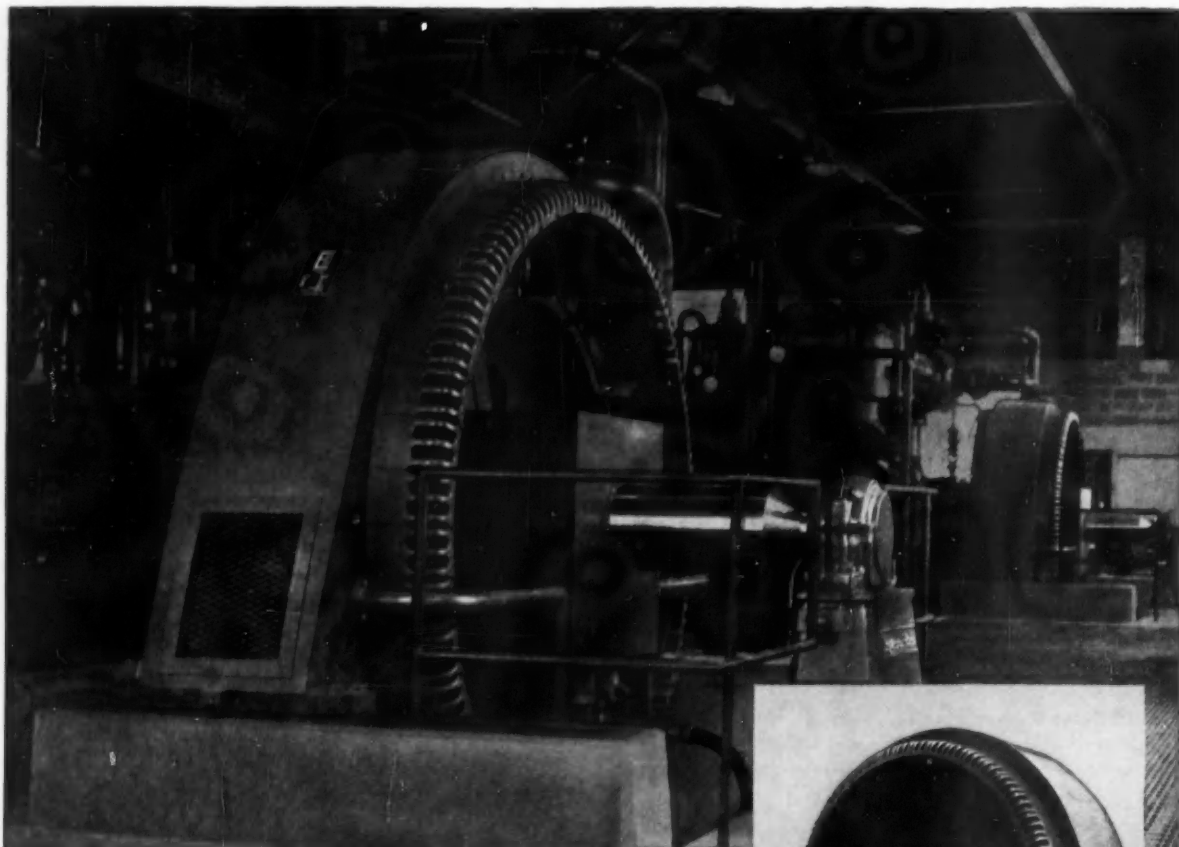
Explosives Department

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Hazleton, Pa.; Joplin, Mo.; Los Angeles, Calif.; New York, N. Y.;  
Pittsburgh, Pa.; Salt Lake City, Utah; San Francisco, Calif.



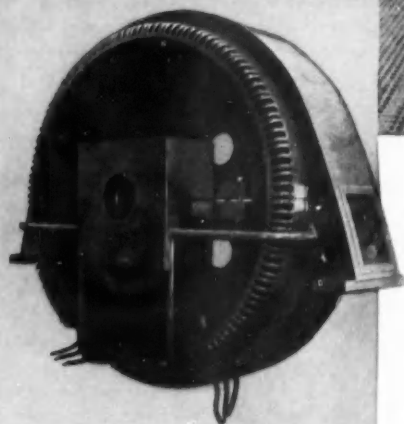


## Large Elliott Motors power unique compressor installation

In a New England chemical plant, two 3500-hp, 300-rpm Elliott synchronous motors furnish the power to drive compressors which are the heart of an ammonia process. The unique feature of the installation is that the compressors each provide *four* services, one more than has ever been attempted before.

The motors are started across the line, being brought up to speed and field-applied in four to five seconds with a minimum of disturbance to the system voltage and a momentary frequency drop of less than 0.5 cycle. An Elliott 7500-kw turbine-generator, operating as an isolated unit, is used for starting.

Elliott offers broad experience in many fields of motor applications to assist users in achieving greatest economy and dependability of service. Consult the nearest Elliott District Office, or write Elliott Company, Ridgway Division, Ridgway, Pa.



### Built to stand up on the toughest jobs

The rigid Fabristeel construction, unequalled insulation protection and other features of Elliott large motors give them the stamina to withstand the most severe service. The motor shown above is one of those installed in the plant illustrated in the photograph at the top of the page. Its rugged construction is apparent.

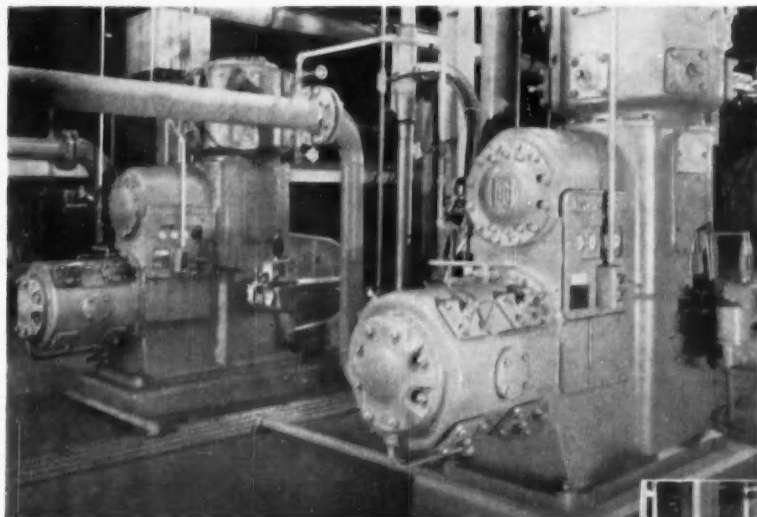
# ELLIOTT Company

RG-18



STEAM TURBINES • MOTORS • GENERATORS  
• DEAERATING HEATERS • EJECTORS • CONDENSERS •  
CENTRIFUGAL COMPRESSORS • TURBOCHARGERS  
• TUBE CLEANERS • STRAINERS

# Versatile Compressed-Air Power AIDS PAPER-MAKING



## Ingersoll-Rand Compressors provide 5 main services... help maintain high production of quality newsprint

These I-R compressors at the Bowaters Southern Paper Corporation in Calhoun, Tenn., provide air power for 5 vital plant services. In every one of these applications, a continuous and dependable supply of compressed air is essential to sustained high production of quality newsprint paper. Bowaters chose the right I-R compressor for each job from the wide range of types and sizes available.

Ingersoll-Rand ES, ES-NL and XLE compressors, like all other equipment in this large, modern plant, were selected on the basis of their ability to give long, trouble-free operation in continuous, heavy-duty service. ES and ES-NL compressors are available in sizes from 5 to 150 hp; XLE units, 125 to 350 hp.

I-R centrifugal pumps, too, play a leading role in the Bowaters power house, including two 6-stage boiler-feed pumps, two desuperheater and three deaerating heater pumps.

For long-range economy in meeting your compression and pumping requirements, call in your Ingersoll-Rand representative. His experience can save you time, effort and expense in solving your plant problems.

### Only Ingersoll-Rand Compressors have CHANNEL VALVES

High efficiency • Quiet operation  
Durability • Air-cushioned action  
Corrosion resistance • Freedom from  
warping • Long, trouble-free service



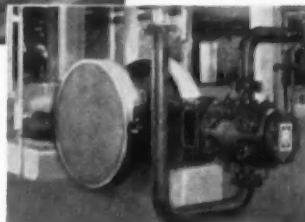
## Ingersoll-Rand

11 BROADWAY, NEW YORK 4, N. Y.

## at Bowaters Southern Paper Corporation

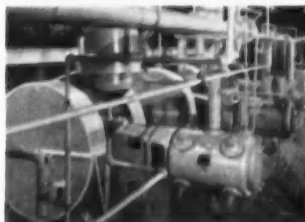
### GENERAL PLANT AIR

These two Ingersoll-Rand XLE compressors, driven by 150-hp motors, supply general service air for the Bowaters newsprint mill.



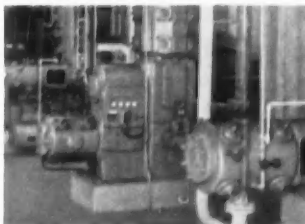
### WRAPPING-MACHINE AIR

Ingersoll-Rand ES compressor supplies 100-psi air for operation of a wrapping machine at the Bowaters plant.



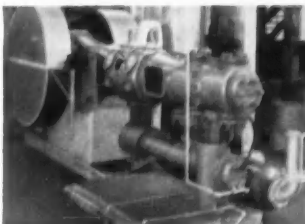
### INSTRUMENT AIR

Three ES-NL compressors with non-lubricated cylinders, supplying clean, oil-free instrument air. NL cylinders have graphitic carbon rings—require no oil or other lubricant.



### POWER-HOUSE AIR

Ingersoll-Rand two-stage XLE compressor (center) supplying general service air for use in the Bowaters steam power plant.



### SOOT BLOWING AIR

Two-stage ES compressor with integral inter-stage cooler, supplying 350-psi air to puff-type soot blowers in the power plant.

I-635

COMPRESSORS • GAS & DIESEL ENGINES • PUMPS • AIR & ELECTRIC TOOLS • CONDENSERS • VACUUM EQUIPMENT • ROCK DRILLS

NOVEMBER 1957

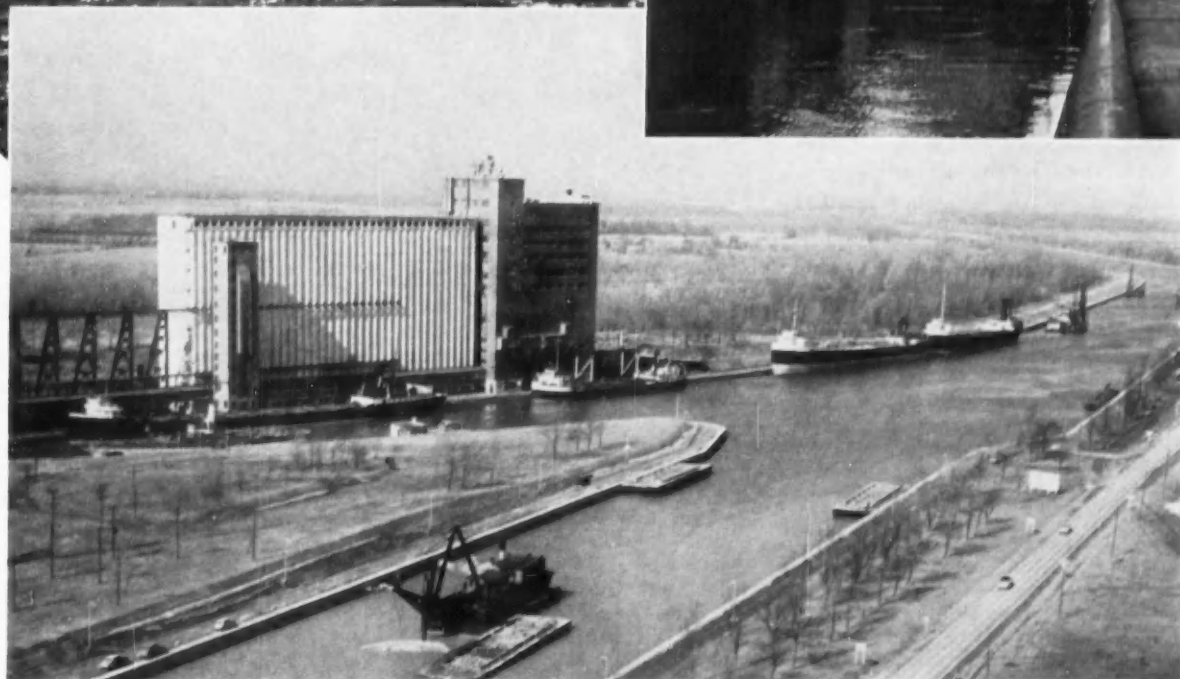
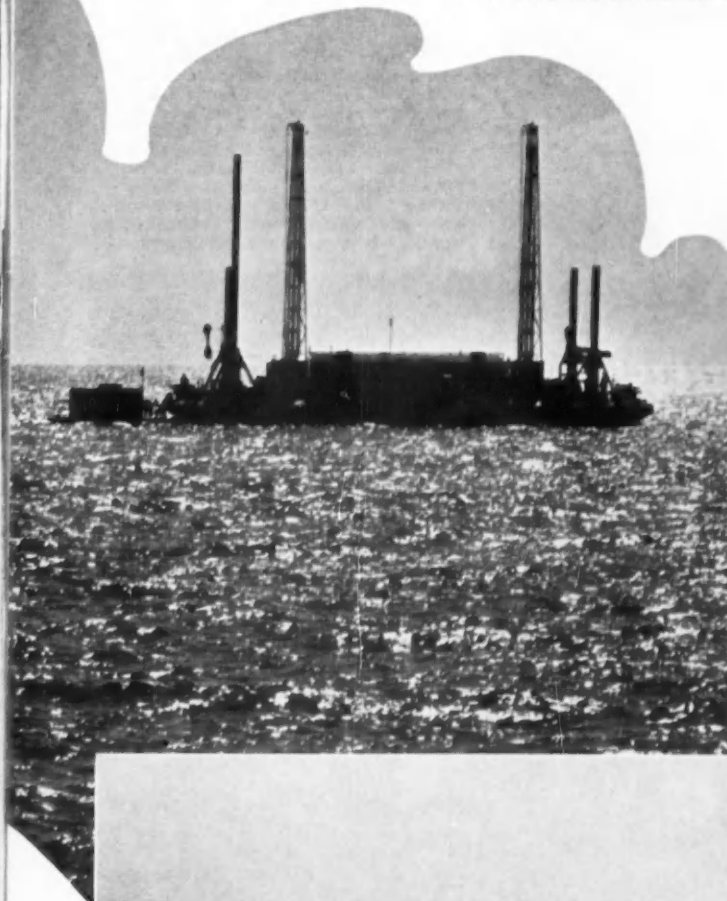
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#### A SILVERY SETTING

Looking out onto Lake Ontario from near Port Colborne, a drill boat and dredge are shown etched against the sparkling water of the inland sea. The vessels are working on the outer fringe of the joint Canadian Dredge & Dock and McNamara Construction Company contract.



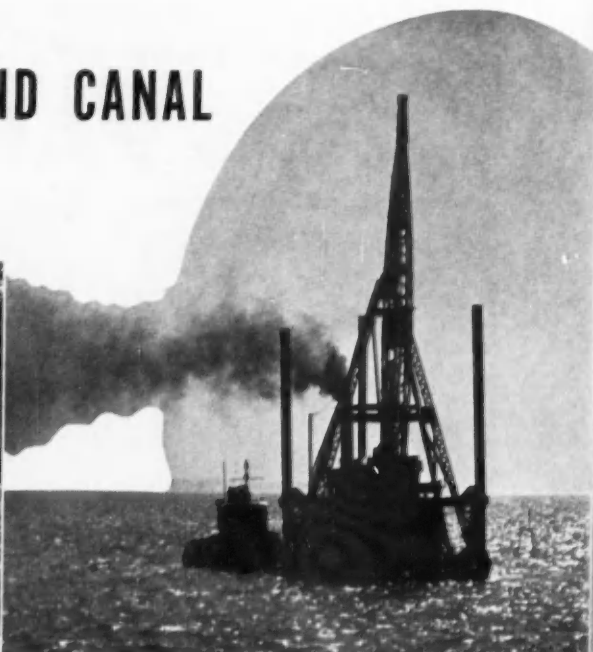
#### SCENES ALONG THE WELLAND

In the aerial photograph, directly above, is shown a dipper dredge (foreground) and two drill boats (right). The large elevators at the left are part of the Colborne mills of Robin Hood Flour Company. Rock in this section is pre-

dominately limestone and gypsum. At the top, right, the mighty boat (Great Lakes sailors rarely use the nautical term "ship") "Lemoyne," 670 feet long, passes through the flight locks of the Welland.

# DEEPENING THE WELLAND CANAL

J. P. Smallwood



ASK the proverbial man in the street about St. Lawrence Seaway construction work, and he will probably know something about the vast and well publicized earth moving operations now underway near Cornwall, Ont., and Ogdensburg, N. Y. Probably he will also know something of similar undertakings further downstream near Montreal. Only a few in the immediate vicinity, however, are aware of the important channel deepening jobs that are necessary at other key points throughout the Great Lakes before the dream of the 2500-mile inland-ocean waterway is realized.

One of the most significant of these is now underway in the 25-mile-long Welland Canal. Ranking in importance next to the "Soo," Suez and Panama "ditches," the Welland cuts through the Niagara Peninsula from Port Weller on the east, to Port Colborne on the west. (Another channel project, the deepening of the Detroit River passage between lakes Huron and Erie, will be described in a subsequent issue.)

The Welland Canal, utilizing eight locks, tames for navigation purposes the mighty obstacle of Niagara Falls. To Champlain, LaSalle, the Indians before them, and the steady stream of voyagers after, the scenic cascade presented the first truly unnavigable water on the journey to the continent's interior. Rapids to the east had somehow been conquered by poling or pulling canoes



PHOTOS, LAKE CARRIERS' ASSOCIATION

## EARLY VIEWS OF THE CANAL

At the top, left, is a reproduction of a picture of the first Welland Canal showing a remnant of its wooden lock wall. The first vessel passed through it from Port Dalhousie to Buffalo, N.Y., on December 2, 1829. Originally there were 40 wooden locks, each 22x110 feet in size. To accommodate larger vessels, the canal was enlarged in 1850. Each lock, made of stone, was increased to 150 feet in length and 26½ feet in width. The illustration immediately above shows this second passage at a place near St. Catharines, Ont.

and bateaux through the fast water. Only Niagara's awesome barrier forced them to debark for a backbreaking overland trek of man-carried boats and cargo up the escarpment and through forbidding forests and swamps from Lake Ontario to Lake Erie.

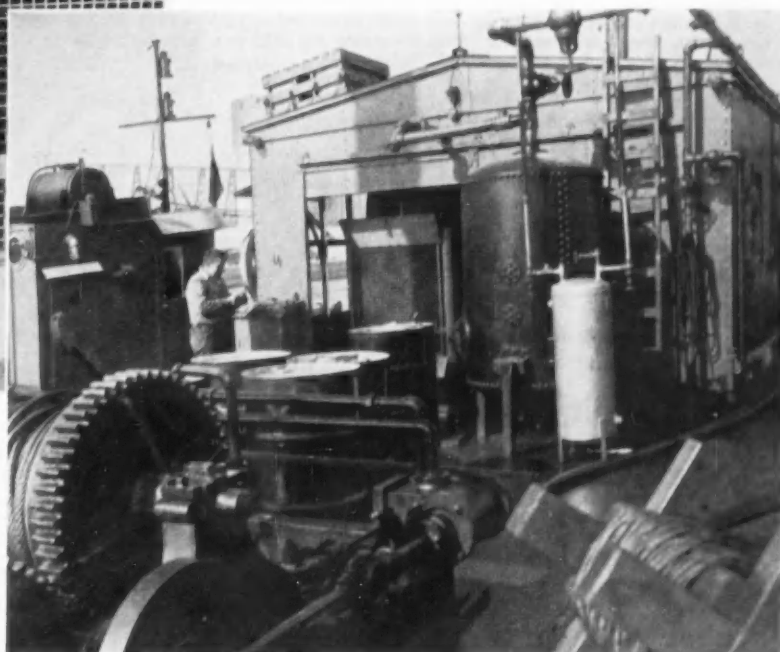
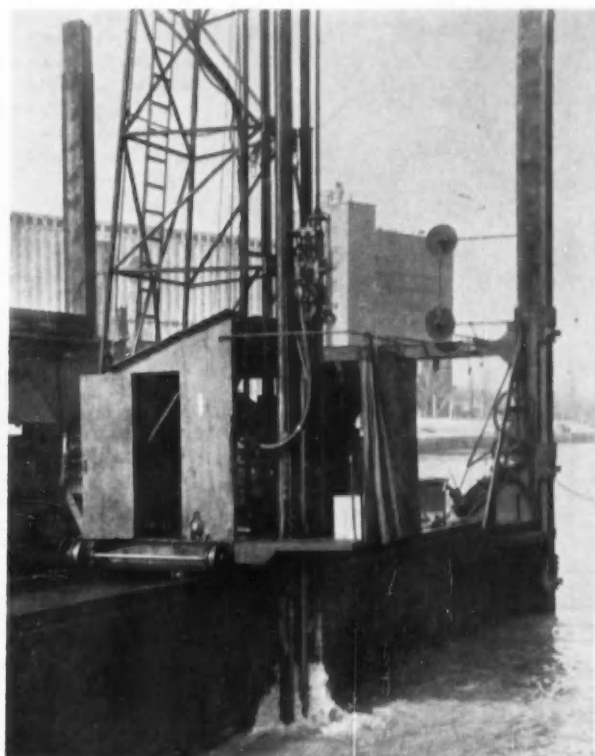
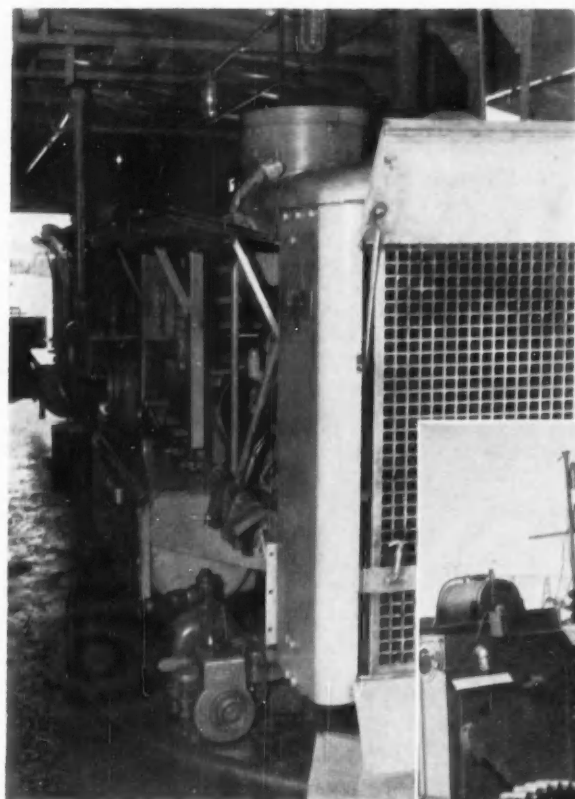
Those pioneers would stand in awe of the Welland as it now exists. Making possible the shipment of huge tonnages of iron ore, wheat and other vital com-

modities into, and from, the industrial and agricultural heart of the continent, the present canal can handle the largest of existing lake freighters. Seven of the eight locks are 859 feet long, 80 feet wide and have 30 feet of water at their sills. The eighth lock, which is thought to be the largest in an inland waterway, has a length of 1380 feet.

More than 62 million cubic yards of rock and earth were excavated from this

# EQUIPMENT LAYOUT

These illustrations, taken on Canadian Dredge & Dock boats, show the layout of that firm's vessels. At the right is a close-up of a drill tower. The little hut and the canvas screen, built out around the drilling platform, are to shelter the drillers from icy blasts of wind. The platform and drill tower are mounted on small wheels that ride a track running from one end of the boat to the other, thus making it easy for the rig to be positioned in any desired spot. The towers are hitched to spring lines attached to a winch at each corner of the hull. The winches are powered by Ingersoll-Rand RC 10 air motors. Compressor installations on the posts are depicted in the two illustrations below. Each boat carries two 600-cfm units, the ones shown being I-R Gyro-Flo (rotary) machines. In the picture at the bottom, right, can also be seen the air receiver and part of the air header that runs the length of the boat and from which the drills are supplied.



rock and material that has been previously blasted.

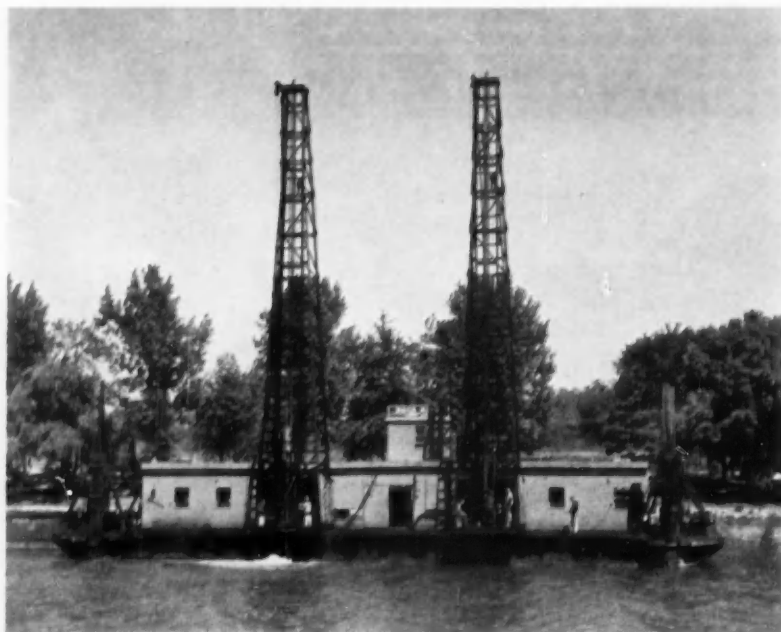
In front of the gates at Lock No. 8, McNamara Construction Company used an air-cushion\* blasting technique as a safety measure. Compressed air from a 600-cfm compressor was forced through a 2-inch pipe having 1/8-inch holes 6 inches apart. The pipe extended completely across the front of the lock and close to the bottom of the channel. The bubbles from this pipe produced the desired cushioning effect to prevent possible damage to the lock gate mechanism.

In one section requiring submarine drilling, Russell Construction Limited of Toronto, a subsidiary of Balfour, Beatty (Canada) Ltd., has a \$7,000,000

contract for the removal of 400,000 cubic yards of rock and 250,000 cubic yards of common material over a 4 1/2-mile stretch near Thorold. General superintendent on the job is J. ("Jack") Fennesbeck and A. ("Al") Gaylord is in charge of the drill boats. Two boats are operating, one of which started April 21, 1957, and the other, June 24, 1957.

Both Russell boats are equipped with Ingersoll-Rand Drillmaster components, air hoists and compressors. Each unit has two Drillmaster towers with model DHD-325A Depth-Master down-the-hole drills and Roto-Master independent rotation air motors. The advantage of the down-the-hole drill is that none of the energy of the drill is wasted in over-

\*See COMPRESSED AIR MAGAZINE, August 1954, "Miraculous Bubbles."



#### THE ROYAL FAMILY

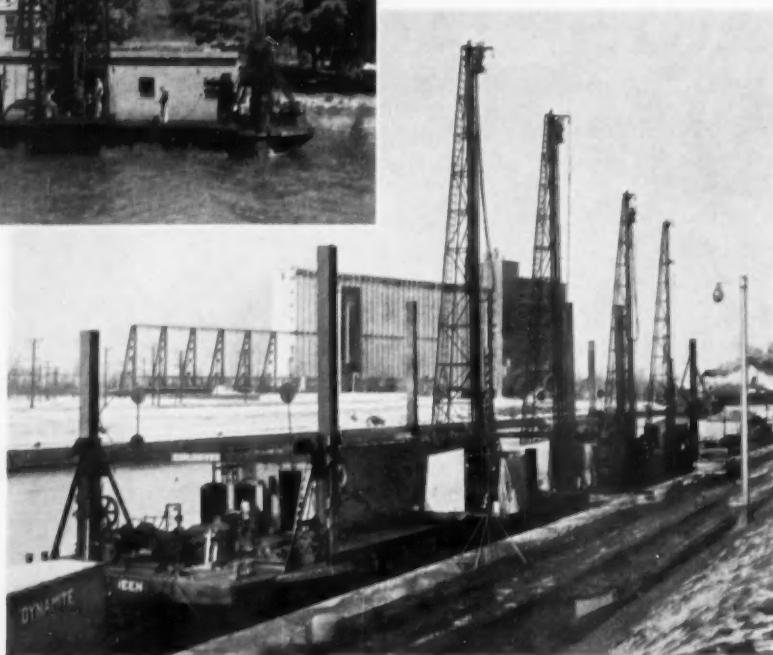
The "Rock King," a veteran drill boat, has been equipped with three generations of Canadian Ingersoll-Rand submarine drills since 1900. When built, the King was equipped with steam drills; in 1936, with X-80 air drills; and, in 1957 with DHD Drillmaster down-the-hole drills and other components including 600-cfm Gyro-Flo (rotary) portable compressors. The head of Canadian Dredge & Dock Company's royal family is shown in the illustration at the left. Below is shown the "Rock Queen" (foreground) and the "Rock Prince." The Queen and the Prince also are equipped with Drillmaster down-the-hole drills and components.

huge ditch, which is 310 feet wide at the water line and 200 feet, at the bottom. A total lift of 327 feet is overcome by the canal. It has a total of 20 highway and railroad bridges that are raised to permit ships to pass. The canal carries heavy traffic, except during 4 months of the year when it is closed by ice. In 1956, all previous records were broken when it was used by 9953 vessels that transported 23,066,261 tons of freight, an increase of 2,173,039 tons beyond the 1955 figure.

Always an important commercial artery for both the United States and Canada, it will play an even greater role in the continent's economy as part of the St. Lawrence Seaway, particularly in respect to shipments of iron ore to inland ports from the vast Quebec-Labrador deposits. Even with the present necessity for transhipment to smaller boats near Montreal, to navigate the 14-foot locks between Montreal and Prescott, iron ore shipments through the Welland Canal increased by 862,880 tons last year.

The present enlarging operations on the Welland are dictated by the governing dimensions as specified by the St. Lawrence Seaway Authority. The existing governing depth is 25 feet, and that must be increased to 27 feet. Doing so constitutes a \$21 million job, of which approximately half has been completed. The Divisional Engineer in charge is W. A. O'Neil who is assisted by F. Phippard. The divisional administration officer for the Seaway Authority is J. A. MacPhee.

At the north end of the canal, three sections between the first and fourth locks can be dewatered during the winter



shut down. Three of the "dry" contracts in that section involved the removal of 194,000 cubic yards of common material and were completed in the winter of 1955-56. The work was done by the McNamara Construction Company of Toronto with a \$409,000 contract, and Aiken and MacLachlan of St. Catharines, whose portion of the job was valued at \$130,000. A third, and similar contract in the same section, calling for the removal of 500,000 cubic yards, has been in progress for two winters and will continue during the 1957-58 season. At the Port Weller, Lake Ontario, end of the job, J. P. Porter Company of Montreal completed (April 1957) a contract for the underwater dredging of 320,000 cubic yards at a cost of \$604,000.

An especially difficult part of the whole project, however, is the rock dredging required in the upper section from Thorold to Lake Erie, even though both the type of materials present and

the depth to bedrock were well known in advance. Because water from the canal is required for industrial and domestic purposes, dry excavation is not possible. Turbidity must be kept to a minimum, and, except during the winter, heavy ship traffic in the canal adds to the problems of the drill boat and dredge operators. Despite the utmost in safety precautions, one collision has already occurred, however, with only moderate damage to one of the drill boats. Fortunately, no one was hurt.

The contractors must also handle the complexities of considerable overbreak from a relatively shallow hole (average depth of 9 feet), as well as take necessary precautions to avoid damage to canal walls and shore line real estate. The latter is accomplished by line-hole drilling along the canal wall on 10-inch centers. Special care is taken in blasting these; light charges are used for a distance of 25 feet out. Added is the problem of drilling and blasting in broken





#### GRINDING CARSET JACKBITS

Drilling along the Welland Canal is tough on bits. In many places old iron or steel rails imbedded beneath the canal interfere seriously with the operations. Good bit care is important in assuring the maximum speed and efficiency. In the picture above a McNamara employee is shown touching up one of the Carset bits used by that firm on its three drill barges. The grinder is an Ingersoll-Rand size 4G28.

coming the inertia of long lengths of heavy drill steel—the drill actually follows the bit down the hole. The Roto-Master insures that no drilling energy is wasted in rotating the bit and rods. It enables extra rotary power to be applied for drilling in broken ground or fighting a tight hole. Carset bits, fitted with tungsten carbide inserts arranged in an X design to eliminate rifling, are used. Bits are ground on the job, with either a stand-mounted precision grinder or a hand grinder, both of which are air operated. On each boat, air power is supplied by two 600-cfm I-R Gyro-Flo (rotary) portable compressors on skids.

The type of rock encountered is a medium-hard limestone in which an average drill pattern of 8x8 feet is used. The average drill penetration rate is 32 feet per hour. Each 9-foot-long hole is loaded with two Nitrox cans and one Nitro-ne Primer. The barge is moved off and a complete line of seven or eight holes is blasted.

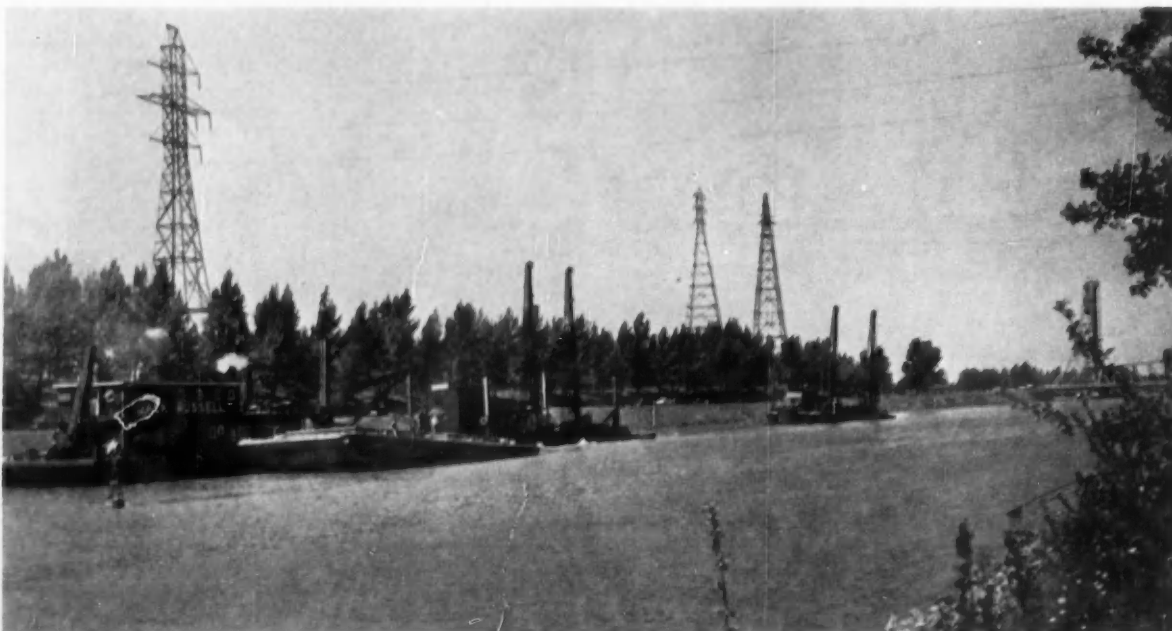
Ordinarily, dredged material is deposited in nearby dumping grounds in the river or on land in a settling basin. Sometimes it is opportune to build up the canal banks either to improve the hydraulic characteristics of the channel or to build up low spots for real estate. In this case, suction dredges and shore-based drag lines are used to place the mud or rock. A problem arises however, when no adjacent land is available for dumping purposes. Then dredged ma-

terial must be scowed out onto Lake Erie, involving long trips and often passage through locks.

Near the outlet to Lake Erie another rock job is underway in a joint venture of the Marine Division of McNamara Construction Company, and Canadian Dredge & Dock Company. They are contracted, in the amount of \$11,623,000, to remove 672,000 cubic yards of rock lying in a stretch of 4.4 miles north, and an equal distance south, of the town of Port Colborne. Work got under way in September 1956, and is expected to be completed about September 1958.

Drill boats belonging to Canadian Dredge & Dock Company Limited are also equipped with Ingersoll-Rand Drillmaster components, air hoists and Gyro-Flo (rotary) compressors. They are using 4¾-inch Carset bits. Superintendent on the job is R. ("Bob") Phair whose engineering assistant is C. ("Colin") Fairn. The three drill captains are Fred Thoms, James Bon and Bert Ellis. In addition to the three drill boats, the company uses two dipper dredges, three tugs and five scows. Their total working force is about 120 men.

Canadian Dredge & Dock Company Limited started its drilling operation September 18, 1956, using the *Rock King*. A second boat, the *Rock Prince*, started October 18, 1956; and February 11, 1957, a third boat, the *Rock Queen*, was put into operation.

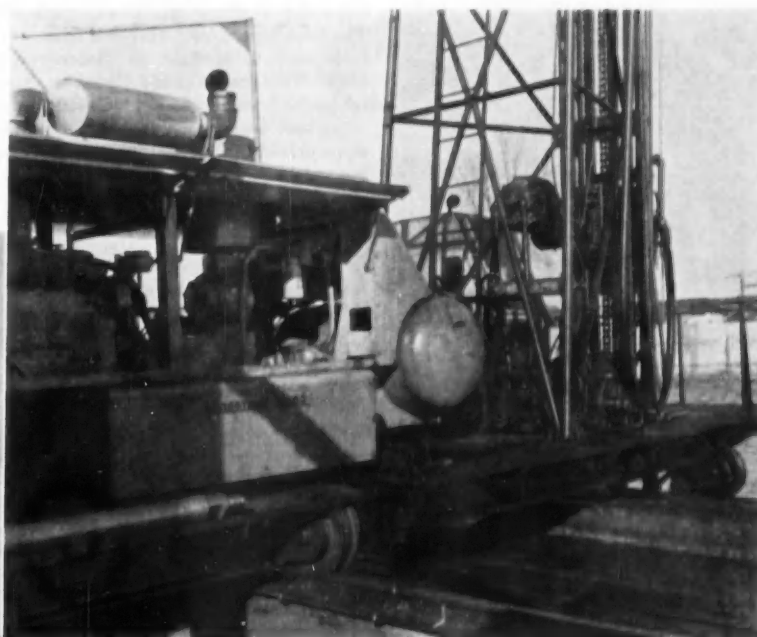


#### THE "JACK RUSSELL"

Shown in the picture above is the dipper dredge "Jack Russell," part of the equipment the Russell Construction Company has working on its contract just above Thorold, Ont. To the left of the dredge are the firm's two drill boats. The Russell drill barges are equipped with Ingersoll-Rand

down-the-hole Drillmaster drills and components and with Gyro-Flo (rotary) air compressors of 600-cfm capacity. All sections of the Welland are being cut down to a depth of 30 feet to comply with the governing depth of 27 feet along the entire St. Lawrence Seaway.





#### UNIT CONSTRUCTION

McNamara Construction Company, Ltd., uses two drill boats arranged as in these photographs. The compressor moves right along with the feed tower on guide rails running the length of the vessel. Enclosed drilling platforms hang out over the edge of the vessel, as shown in the illustration at the left. The other picture (above) shows the means by which the rotary portable compressors are mounted behind the drill tower. The machine shown is an Ingersoll-Rand 600-cfm capacity Gyro-Flo. Both drill boats mount I-R Drillmaster down-the-hole drills (DHD-325A) and Rotomaster independent rotation motors. These boats use I-R 6-inch-diameter Carset (tungsten carbide insert) bits. A third drill boat, equipped with a modified SD65 Quarrymaster drill for submarine drilling, also uses the 6-inch-diameter bits.

At present the *Rock King* is working on the north end of the contract on the east side of the canal, drilling into a combination of gypsum and limestone. Holes are 9 feet deep and have a diameter of  $4\frac{3}{4}$  inches on an average spacing of 5x5 feet. Drilling on the west side of the north end has been completed. The *Rock Queen* and *Rock Prince* are working on the south end near Port Colborne, on the west half of the channel, drilling 9-foot-deep holes in tougher onondaga flinty limestone on an average spacing of 6x6 feet.

The *Rock King* is a familiar veteran of Canada's canal system, having worked for more than 50 years at various spots throughout the Great Lakes, including earlier Welland jobs, and as far east as Quebec City. During that time, it has undergone two conversions, both to take advantage of newer equipment offered by Ingersoll-Rand for more efficient submarine drilling.

Around 1900, it first had Rand steam drills that were replaced in 1931 by Ingersoll-Rand X-80 Hammer drills. Then, during the early part of 1957, with the prospect of several years' work

on Seaway deepening projects, her owners decided to equip the seaworthy old-timer with the latest Drillmaster equipment and down-the-hole drills.

The Marine Division of McNamara Construction Company Limited is working with three drill boats under the supervision of superintendent F. J. ("Fred") Scott in the same general area as Canadian Dredge & Dock. Two of the vessels are Drillmaster equipped, and the third mounts an Ingersoll-Rand Quarrymaster piston-type drill that has been modified for submarine drilling. All use 6-inch-diameter Carset bits. Other equipment includes dredges, dump scow, tugs and two clams for removing blasted material.

This contract is a relatively tough drilling proposition. The contractor must contend with a heterogeneity of limestone, flinty chert and conglomerate. Despite this, the average drilling penetration rate is about 15 feet per hour. Another problem is caused by an abundance of old, embedded iron and steel rails that tend to shatter the tungsten carbide drill-bit inserts and clog the blow holes on the bits so that they must be taken

out of service and drilled out. These trouble-some relics of bygone days are evidence of the many changes the canal has been subjected to in its 125-year history.

We can trace Welland history back to 1699 when a French engineer, Vauban, who knew the area only from maps, declared that he saw no reason why a canal could not be built to bypass Niagara Falls. While Upper Canada was still under French rule, the same idea was presented to the French court, but without success.

Under English rule, two other groups outlined proposals to the Upper Canadian Parliament. Both were defeated. Suggestions that a canal be built were offered during the years immediately following the War of 1812 when both the United States and Canada became canal minded. Col. Robert Nichol attempted to obtain public funds for the project by introducing a bill in the Upper Canadian Parliament in 1816, but the measure was defeated.

It wasn't until 1818 that the first successful effort to build a canal was made. Leader of the movement was William



PHOTO, LAKE CARRIERS' ASSOCIATION

### TWIN LOCKS

In the illustration above, the S.S. "Coverdale" can be seen in the west lock of the twin locks. The photograph was taken looking north, and the vessel is upbound.

Hamilton Merritt whose plans for a 15-mile canal from Twelve-Mile Creek to the Chippawa River (now Welland) was accepted by Parliament. It organized the Welland Canal Company, and residents of the Niagara area bought stock in it. Near the end of 1824, when \$150,000 had been raised, the first earth was turned at Allanburg, Ont., by the

Company's president, George Keefer. The first vessel went through from Port Dalhousie to Buffalo on December 2, 1829. This first Welland Canal was contemporary with the Erie Canal which went into service in 1825. During the same period the \$4,000,000 Rideau Canal between Ottawa and Kingston was constructed, as well as the Lachine Canal near Montreal.

The initial Welland waterway had 40 wooden locks, each 22 feet wide and 110 feet long, and a governing water depth of 8 feet, thus enabling the small craft of that era to ply between the two lakes.

When shipping outgrew the first Welland Canal, the government of Upper Canada built a larger one, finishing the final section in 1850. Each of its locks, formed of cut stone, was 150 feet long, 26½ feet wide and had a governing depth of 9 feet. By 1871, it was inadequate and a Canadian canal commission recommended a third waterway. It was constructed with locks 270 feet long, 45 feet wide and 14 feet deep and was ready for service in 1887. Its 26 dimension-stone locks are still considered fine examples of masonry work.

By 1928, ships 630 feet long, 70 feet wide and drawing 20 feet of water were plying the Great Lakes, most of them carrying wheat. To accommodate them and the larger ones to come, a fourth canal had been started 13 years before.

Work had been interrupted by the Great War in 1916, but was continued following the conflict, and the Welland Canal, as we now know it, was officially

opened on June 27, 1931. Completed at a cost of \$133 million, it would cost about \$300 million to duplicate today.

Expansion programs partly inspired by the current canal improvements are now under way by such local firms as Atlas Steels, International Nickel, Page Hersey Tube Company, Electro-Metallurgical Company, General Tire & Rubber Company and the Ontario Paper Company. In addition to this, the Welland Canal area is receiving increasing attention from industry in the United States, overseas, and elsewhere in Canada. Heavy industry likes transportation and the land adjoining it. Land is abundant in the canal area and, as well as the prospect of increasingly better water transportation, the region is served by two railroads with transcontinental connections and by a network of hard-surfaced highways suitable for heavy transport. The prospect of deeper port facilities at Port Colborne, as a result of Seaway expansion, could bring a marked increase in commerce to that community.

The question has been raised in several quarters as to whether or not the deepened Welland Canal will be adequate for immediate future demands of both commerce and war-time security. So, even as the present work proceeds, the possibility of a second series of seven locks at Welland, of similar specifications, and parallel to the existing ones, with an estimated cost of about \$100 million, arises to titillate the imagination of Seaway planners.



### MOVING A DRILL BOAT

Against a backdrop of one of the Welland Canal's 20 lift bridges, the tug "Sea Hound" and another smaller vessel pull one of McNamara Construction Company's three drill

barges to a new location. There are eight locks in the Welland, one of them thought to be the world's largest in an inland waterway.

# SPECIALIST IN AIR DEVICES

Norgren Pneumatic Products Have Gained World-Wide Acceptance

C. H. Vivian

THE C. A. Norgren Co., of Englewood, Colo., a suburb of Denver, conducts a business that is based almost entirely on compressed air. The firm makes air line lubricators, air line filters, pressure regulators, control valves and related products that are used the world over. Most of them are small enough to be held with one hand, but they contribute importantly to the smooth and efficient running of many large factories. About 55 percent of those made each year go to manufacturers of machine tools and other equipment who put them on their own products before shipping them. This is called the original equipment market (OEM). The rest are sold for application to production lines or hand-held power tools. More than 4 million Norgren units have been put to useful service since the first of them were introduced about 30 years ago. They come in more than 600 standard models and sizes.

Norgren preaches the gospel of proper compressed air processing and three of its products are designed to insure clean air at the correct operating pressure for the work being done and to provide unfailing lubrication of hand-held tools and larger equipment. Industry has long since learned that taking these simple precautions will add service life to equipment and insure the best possible work with minimum maintenance and repair expense.

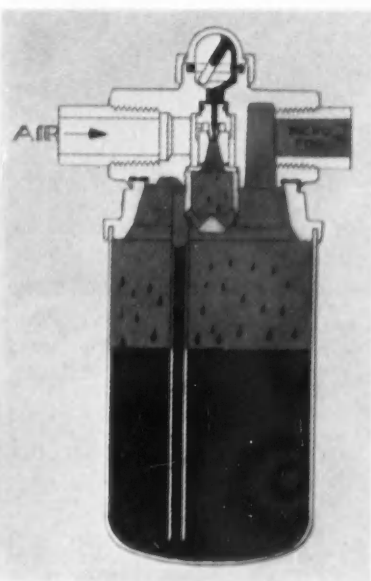
Most well-run air compressing plants filter the air before it goes to the compressors, but this cannot protect it from sources of contamination beyond the intake. Pipe scale, pipe dope, emulsified and deteriorated compressor oil and condensed moisture all get into the stream of compressed air as it moves through the distribution piping. A Norgren filter incorporated in the air line just upstream from the point of use will remove these substances and protect air tools, cylinders, valves or other equipment.

Air-actuated equipment, particularly hand tools, runs best when the manufacturer's specified operating pressure is supplied. If a higher pressure is used, wear is increased and the life of the equipment shortened. Moreover, the additional work done is not often proportionate to the greater volume of air consumed, so power is wasted. A Norgren regulator interposed in the air delivery line will hold the pressure at the optimum operating level.



## THE PLANT IS INVITING

The front portion has walls of pink quartzitic sandstone quarried at Lyons, Colo., and the entrance doorway is flanked by a panel of Colorado marble. This section of the factory is air conditioned and houses executive, administrative, accounting and engineering offices. Shops are in the rear. The plant faces the front range of the Rockies and is set off by lawns and shrubbery.



## MICRO-FOG PRINCIPLE

Compressed air passing through a venturi section establishes a pressure differential that picks up oil from the bowl and atomizes it. The fog is directed to a sight-feed dome at the top of the device, where the heavier particles are captured and returned to the reservoir. Only the finest particles, with a maximum diameter of 2 microns (.00007874 inch), pass on to the equipment to be lubricated. As this comprises about 10 percent of the total, the quantity delivered as fog can be closely controlled. For example, to feed one drop of oil a minute, the lubricator is set to feed ten drops through the sight-feed dome.

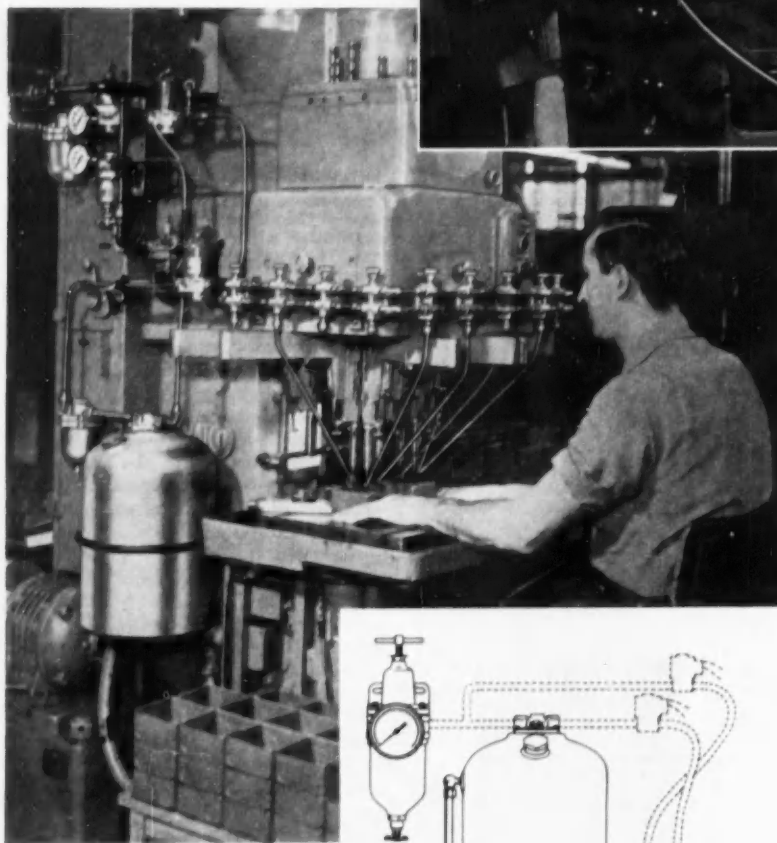
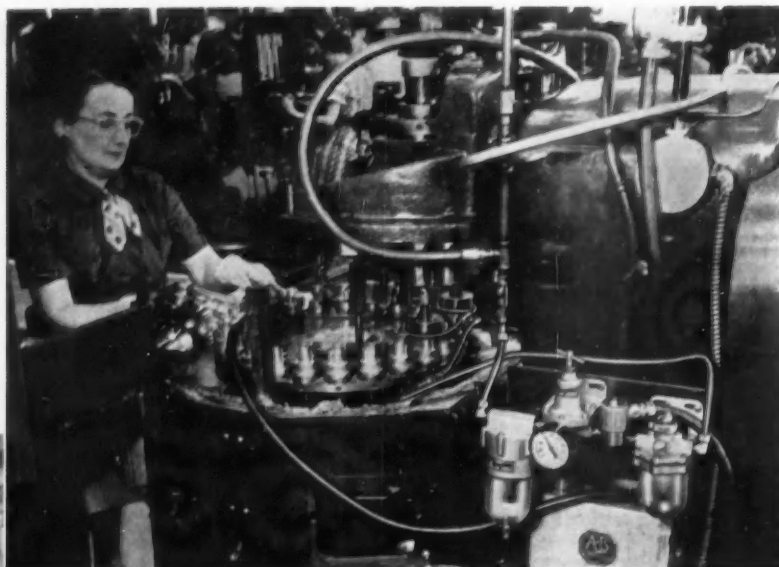
Lubrication of contacting or rubbing surfaces is universally recognized as vital and, fortunately, a stream of compressed air in a pipeline offers a simple, positive, efficient and economical vehicle for conveying the lubricant to the exact locations in air-operated mechanisms where it is needed. The Norgren lubricator feeds carefully metered amounts of atomized lubricant into the air stream so as to coat wearing surfaces with a thin protective film. Air-borne lubrication is automatic—if the equipment is operating, it is being lubricated.

These Norgren accessories are most often used as combinations designed to meet the conditions at hand. When arranged in series, the order of filter, regulator and lubricator is preferred. Norgren also encloses all three in a compact case that measures only a trifle more than 6 inches square on the front and less than 5½ inches deep. To put it in service, it is necessary only to make air line connections on the sides. These cabinet models are especially suitable for use on machine tools or other stationary equipment.

The most fascinating of the Norgren products is the Micro-Fog lubricator. It differs from the ordinary oil-fog lubricator in the fineness of the oil particles produced. Compressed air directed through a venturi section (see accompanying sketch) blasts globules of oil into ultra-fine fog. The finest of the particles are light enough to remain air-borne and are carried along in the stream. The heavier particles are returned to the source of oil supply. For

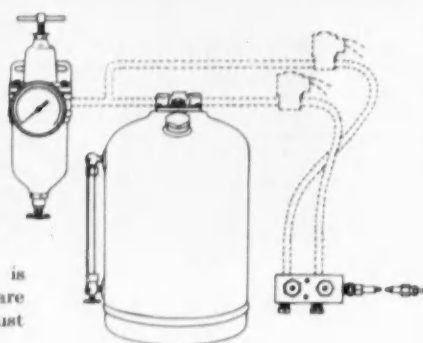
### SAVES \$50 EVERY WORKING DAY

This Norgren Micro-Fog lubrication system serves a Globe tapper having two simultaneously operated tapper heads that chase threads on zinc, die-cast ignition lock barrels. Water-soluble oil pumped through tubing formerly flowed over the chasers and the oil-flooded parts required degreasing before passing to the next operation. Elimination of this step and several other benefits resulting from the change save an estimated \$13,000 a year. The Micro-Fog equipment (lower right) consists of an air filter, air-pressure regulator with gauge, a solenoid valve and a ½-pint-capacity Micro-Fog lubricator. Air pressure of 60 psi feeds approximately 200 drops of lubricant a minute.



### WHERE SPRAY-LUBE INCREASES PRODUCTION

The machine shown at the left performs up to twelve tapping operations at the Square D factory (electrical controls) in Milwaukee, Wis. The taps were formerly lubricated and cooled by a flood system that covered everything — often even the operator and the floor. Now a Norgren Spray-Lube system (control equipment at top-left) does the job cleanly and production is also up 30 percent. Lubricant from a 5-gallon container is fed to twelve mixing valves mounted around the tapping head. Copper tubes extending from each valve terminate in spray nozzles. The nozzles are actuated only when the taps are approaching and contacting the work. The sketch below illustrates the Spray-Lube principle.



this reason, Micro-Fog lubrication is effective even where piping systems are long or complex or where lubricant must be applied at several points.

Micro-Fog lubrication coats bearings, gears and other components of machines with just the right amount of clean oil that is not reused and hence can't deteriorate. One unit will lubricate a large machine tool. Under the metered control, a few ounces of oil a day can do a more thorough job than gallons could under older systems. The air that conveys oil into bearings also cools them and, as a slight pressure is maintained in the housing, contaminants are kept

from entering. So little oil is used that there is no surplus to reclaim or recirculate, so filters, sumps and pumps are eliminated. Ready visibility of the oil feed permits checking the operation; and switches that actuate an alarm if anything goes wrong can be provided.

To help select the appropriate size of lubricator for use with bearings, Norgren utilizes the term "bearing inch."

The shaft diameter measurement in inches represents the "bearing-inch" rating for a single-row, antifriction bearing. For multi-row applications, the shaft diameter is multiplied by the number of rows. One fluid ounce of oil per hour will generally provide effective lubrication for 100 "bearing inches." Micro-Fog lubricators for machine components are available in nineteen models and sizes with maximum capacities of 32, 100, 200, 300 and 1000 "bearing inches." They consume from 2 to 7½ cfm of air when operating. Cabinet units, which include filter, regulator and lubricator, are made in three models, the largest of 2-gallon capacity. Called "lubro-control" units, some models include, by order, an alarm system that is automatically actuated whenever the air pressure fails or becomes excessive or the oil supply needs replenishing.

Another interesting product is the Spray-Lube that atomizes metal-working compounds or cutting oils and applies them in controlled amounts to the tools



in all types of metal-working operations—drilling, tapping, milling, boring, hobbing, grinding, stamping, forming, sawing, turning, etc. It has been demonstrated that a few ounces of fluid applied as a fine spray extracts more heat from the tool than gallons of the same fluid poured over it. As cool tools need sharpening infrequently, cut at maximum speed and last a long time, the Spray-Lube system conserves them. It also is reported to reduce the consumption of oil or other compounds.

One of the numerous examples of its profitable use is found in the Racine, Wis., factory where J. I. Case Company turns out farm machinery. In one operation, 97 holes of up to 1-inch size are tapped at various places in cast-iron transmission cases. The 97 taps were formerly lubricated by hand brushing in 66 seconds; sometimes it was improperly done and taps were clogged with chips and their service life was shortened. Then three Norgren Spray-Lube systems were installed to do the job automatically. By applying generous quantities of lubricant, taps are washed clean of chips, valuable production time is thus saved and a messy operation has been transformed into one that is clean.

Norgren pressure regulators have long been employed by soft-drink bottlers to reduce the pressure of carbon dioxide drawn from high-pressure cylinders for carbonating the water used in mixing drinks. In recent years they have also been adopted for similar service in automatic drink-vending machines. Assemblies are available in numerous arrangements to meet the varying requirements. For instance, a vending machine may dispense three flavors of carbonated drinks, each of which calls for adding the gas at a different pressure. Norgren also makes a regulator to control the

pressure of water used in making hot coffee or other beverages either manually or automatically.

Because Denver is in a rather sparsely populated region and far from the larger markets, it has traditionally been considered an unfavorable place for manufacturing. On the other hand, the climate and living conditions are such as to make for satisfied workers who are not apt to leave. Several firms that turn out rather bulky goods have overcome the location bugaboo, and those whose products are rather small and light, like Norgren's, have less difficulty in operating profitably there. Only about 1 percent of the Norgren product is sold in the Rocky Mountain region; it has been able to compete successfully in worldwide markets.

Since its earliest years, the company has had good cooperation from manufacturers of air tools and production machinery, and these friendly relationships have helped the Norgren line to gain acceptance. Distributors and sales agencies are maintained in 31 cities in the United States, Canada and Mexico. To provide better service to the export

markets, manufacturing under license is being carried on in England, Sweden and West Germany.

The business was founded by Carl A. Norgren, who is still active in it but who is gradually unloading much of the administrative burden on his son, Neil, who serves as executive vice president. After being graduated from the University of South Dakota with degrees in mechanical and electrical engineering, the founder worked in the Fairbanks Morse engineering department and later rose to the position of assistant manager of the Seattle, Wash., sales office of a company manufacturing pneumatic tools. He went to Colorado in 1919 for the benefit of his health and during 5 years spent on the state's western slope, that is, west of the main range of the Rockies, conceived ideas for a hose coupling and other pneumatic devices.

He moved to Denver and started making the coupling in the basement of his home. At first, he assembled the product in the mornings, made sales calls and deliveries in the afternoons. As business increased, operations were shifted to a small shop and later to



#### FIRST AND LAST MANUFACTURING OPERATIONS

Raw materials consist mainly of metals in the form of either castings or bars. Bar stock goes first to the automatic screw machines shown above. As the picture attests, cleanliness and orderliness are stressed. Final operations on complete units are inspection and packaging, and the latter is facilitated by the novel carton vendor pictured at the left. Cartons are opened at an upper level and each size slides down its allotted channel in the inclined server, the lower end of which is within convenient reach of the packers. The men in the foreground are inspectors.





larger quarters. Success didn't come easily, however. At times when the couplings didn't make ends meet, the little shop manufactured fire extinguishers, photograph enlargers and parts for air compressors on a contract basis. About 1927, Norgren developed a spray gun for lubricating automobile springs. There was nothing of the sort available then, and thousands of them were made and sent to various parts of the globe, through the Alemite Corporation.

About this time, Norgren added pressure regulators and filters to the line and, in 1930, he designed and started building the first oil-fog lubricator produced in the United States. The idea for it came to him as he was waiting in the Detroit office of General Motors Corporation to see someone, and he made the first rough sketches while sitting there. If he had been shown right in, nobody can say whether his mental gears would ever again have meshed just as they did then. The lubricator was first used with portable air tools.

The firm rented factory facilities until 1936, when it occupied a property of its own on Santa Fe Drive in Denver. Its 7825 square feet was thought to be adequate for a long time to come but during the next 12 years, seven additions were made and the size tripled. In 1951, a new, modern 62,500 square foot plant was built in suburban Englewood, surrounded by plenty of space and providing an open view of the snow-capped Rockies rising against the western sky. It is the nation's largest plant of its kind, with the largest engineering staff. The offices, on two floors, are air conditioned. The shops, all on one floor, are well lighted, airy and clean.

Raw materials, mostly brass, zinc or aluminum castings or bar stock, come in at a truck-loading dock and flow through the plant in orderly fashion.

The metals, most of which have to withstand pressure in service, must be dense and free machining. Various small parts are machined from bar stock on seven multiple-spindle, and a group of single-spindle, screw machines. Castings pass through automatic and hand-controlled machine tools designed to perform the particular jobs assigned to them. Some of the machines and numerous attachments for others were designed and built by the firm's own tool engineering department. Needless to say, Norgren products are applied wherever they can be used, and the plant thus serves to some extent as a testing laboratory for them.

From the machine shop, parts pass through degreasing and deburring treatments and then go to stock. From there on, the order is assembling, inspecting, spray painting and packing for shipment. Numerous jigs and fixtures assist in holding the small products while they are being put together and at almost every stage of the operations, small air-operated tools of the screwdriver and impact type save the workers' time and muscular effort.

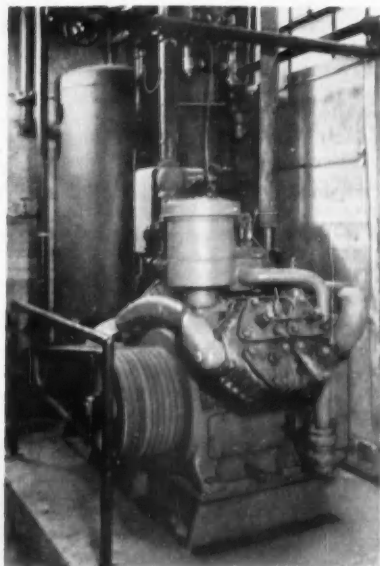
A liberal profit-sharing plan has been in force since 1946. Every employee with 1 year of service, except officers and department heads, receives a bonus at the end of the year that amounts to a goodly proportion of his annual wage. The total distributed thus far is \$1,259,068. Payments are based on the company's net operating profit and are figured monthly. Neil Norgren meets with the employees each month as soon as the books are closed and reports on sales and profits and other matters considered of mutual interest.

It goes without saying that this program has just about eliminated waste, spoilage and labor turnover. And it works as well for the company as for the

employees. Labor rates have increased 342 percent since 1940 and raw materials 172 percent, yet prices of Norgren products have been raised less than 25 percent. A 306-percent increase in productivity per production worker has made this possible. Beginning next July, half of the bonus is to be paid in cash and the remainder is going into a fund that will build up a retirement pension for each worker.

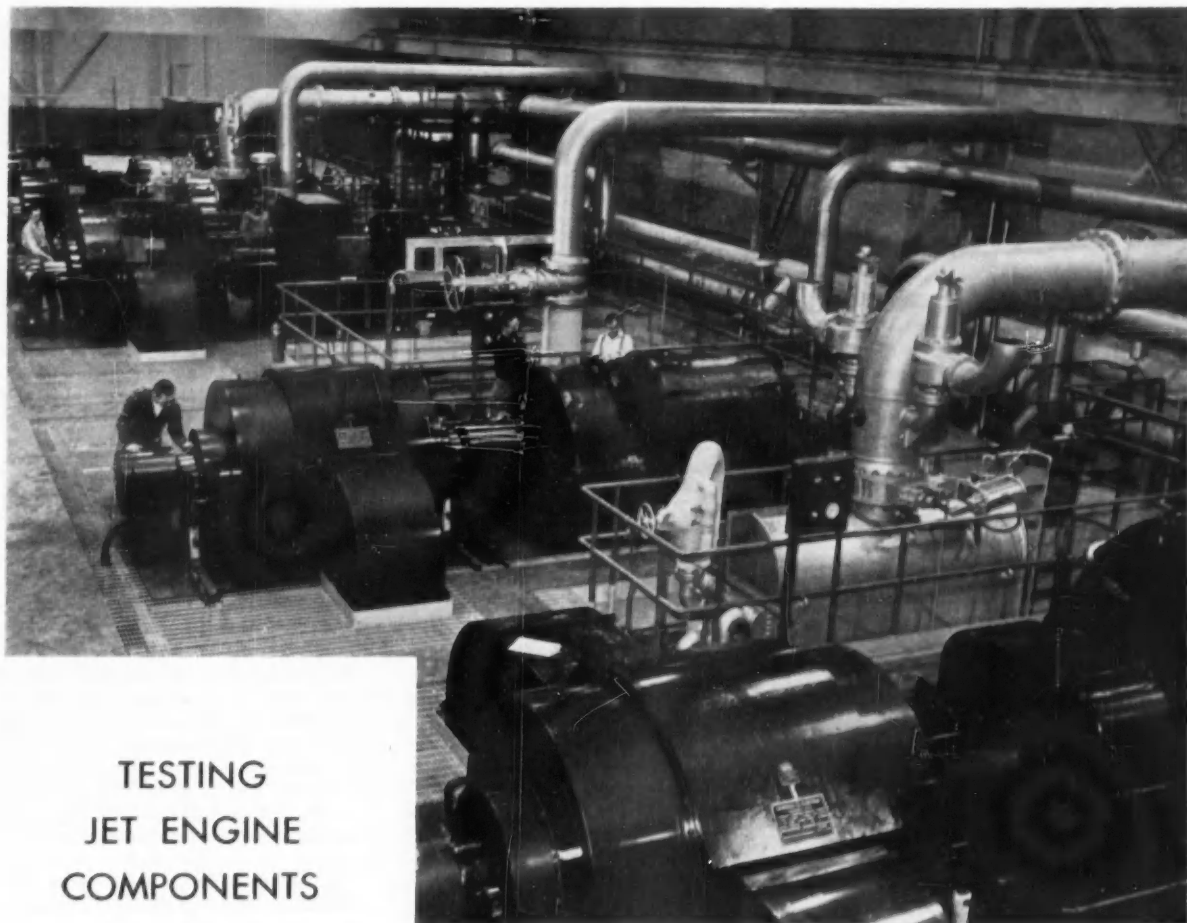
A cafeteria in the plant is liberally patronized by shop and office workers and the management. Provision was made when building it for speedy conversion into a 500-seat auditorium that is available for employee-management conferences and employee and community gatherings.

The visitor is impressed by the scrupulous cleanliness of the factory. "We believe our people come from clean homes and see no reason why they can't work under the same sort of surroundings," says Carl Norgren. "I have been in some industrial plants where I felt like putting on boots before I walked through."



#### TOOLS AND COMPRESSOR

Small pneumatic tools are used at almost every bench in the assembly department. Shown at the left are two Ingersoll-Rand aircraft-type AVC-12 riveting hammers "staking" brass siphon tubes into zinc die-cast filter-regulator bodies. One of them has given 8 years of trouble-free service; the other one is in its second year of use. Pictured above is a 50-hp I-R Type 40 compressor that is a part of the air-supply plant. It discharges at 100-psi pressure and there is also a smaller unit for 100-psi service. A 150-hp machine supplies air at 250-psi pressure. Some of it is used for testing and laboratory work and the remainder is reduced to 100 psi and distributed for general plant use.



## TESTING JET ENGINE COMPONENTS

### Huge Air Supply Aids Research

R. W. Sapora

**I**MPORTANT test facilities developed by the Aircraft Gas Turbine Division of General Electric Company at Evendale, Ohio, help make the design and construction of jet aircraft engines better, safer and less expensive. Just 10 years ago, the most efficient jet engines built delivered about 3 equivalent horsepower\* per pound of weight. Today, G-E builds engines that deliver almost 10 equivalent horsepower per pound of weight—an improvement that would not have been possible without engine component testing facilities capable of duplicating conditions encountered by planes flying at high altitudes and at speeds well beyond that of sound.

The Flight Propulsion Laboratory Department, one of five departments within G-E's AGT Division, maintains

and operates the major engine component testing facilities at Evendale, and similar works in Lynn, Mass. The establishment at Evendale has been modified since its installation to meet expanded requirements, but basic test equipment is complete and has been in operation for several years.

At the multi-million dollar Evendale laboratory, engineers work with tomorrow's advanced jet engines. In pioneering gas turbine propulsion systems for planes and other craft yet unbuilt, their most important tools are the testing facilities that simulate various flight conditions under which new engines will operate. With these "tools," they are able to study the performance of components long before production models of the engines are built. They test new and radical designs that otherwise might not be attempted because of either the danger to personnel or the high cost of

### AIR SUPPLY

A far cry from the free air line at the corner gas station is this air-supply facility furnishing air for testing jet engine components at General Electric's Evendale, Ohio, plant. Five huge turbo-compressors deliver hurricane quantities of air to the combustion, aerodynamic, turbine and other test units; they can be run in series, in parallel or individually to provide air over a wide range of conditions both above and below atmospheric pressure. The electric motors, at the left, supply 27,000 hp to operate the compressors at full capacity.

development. They are able to evaluate high-altitude performance at relatively low cost, without the risks to crews and equipment that are encountered in actual flight. The many advantages of adequate testing facilities have shortened engine development cycles by as much as a full year.

An interesting G-E concept relating to jet engines is that superior units are turned out faster when development or advanced technology is carried on separately from production. Personnel in development work at Evendale have no day-to-day production responsibilities. The demonstration of new principles of aircraft propulsion is treated as a separate product; research and development engineers are able to concentrate on new principles for the engines of 1960, 1965 and beyond.

Wide flexibility is obtained at Evendale through provisions for aerodynamic,

\*Jet engine power is measured in terms of forward force expressed as pounds of thrust. Under certain conditions (at 375 mph), 1 pound of thrust equals 1 hp.

compressor, turbine, combustion and engine testing facilities. In these units, hurricanes of air are applied to parts, or "hardware," to determine the suitability of new designs.

Aerodynamic facilities are available for examining 2- and 3-dimensional aerodynamic models or such engine parts as blade cascades, turbine nozzle diaphragms, diffusers and nozzles. A subsonic tunnel tests parts or models at speeds below that of sound; a supersonic tunnel, at higher speeds. A cascade section and a small, open jet-thrust stand are among the units simulating many different flight conditions.

Small or scale-model, single- and

multi-stage compressors are checked in two special tanks in which a wide range of sea level and altitude conditions can be simulated.

The turbine facility is used for low-temperature (100-375° F) investigation of full-size and scale-model, single- and multi-stage turbines under simulated flight conditions. High-temperature turbine testing is done at the Lynn, Mass., laboratory at the present time.

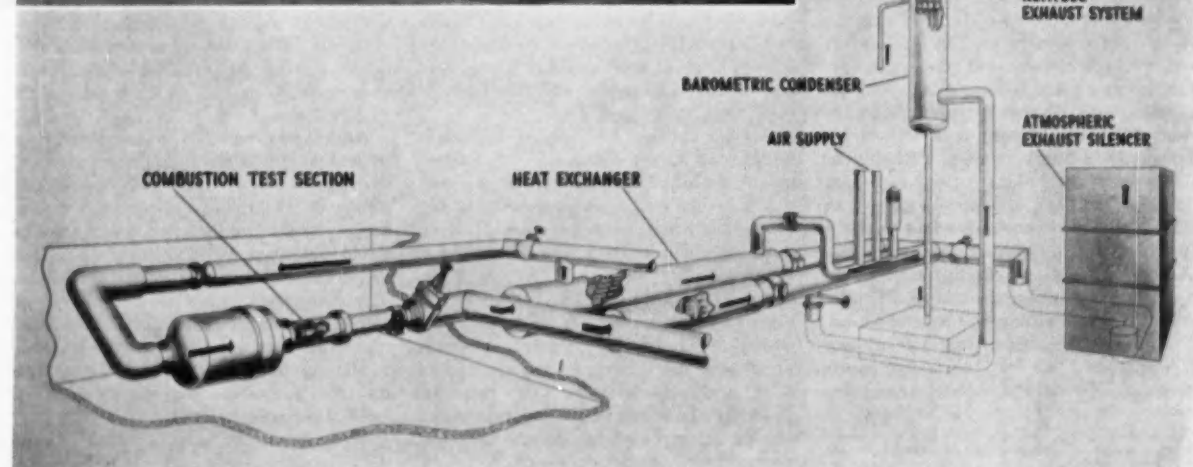
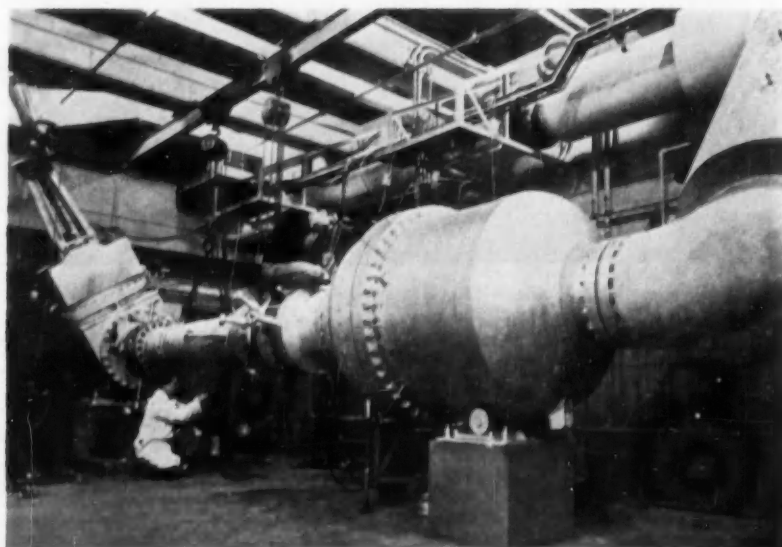
Various cells or compartments provide for combustion evaluation, also over a wide range of sea level and altitude conditions. Some of the combustion components examined are jet nozzles, flame tunnels, and full-size and scale-model

burners and afterburners. One cell normally used for checking small or scale-model main burners and afterburners can also be used as a general purpose combustion cell for a variety of special tests. Another is used to evaluate and develop small or scale-model combustors and afterburners burning special fuels.

Varied and complex instrumentation systems gather and interpret data developed in the facilities. Equipment includes digital computers; closed circuit television; high-frequency, multi-channel, magnetic-tape recording systems; high-speed cameras; analog computers; and many delicate measuring devices.

### COMBUSTION TESTS

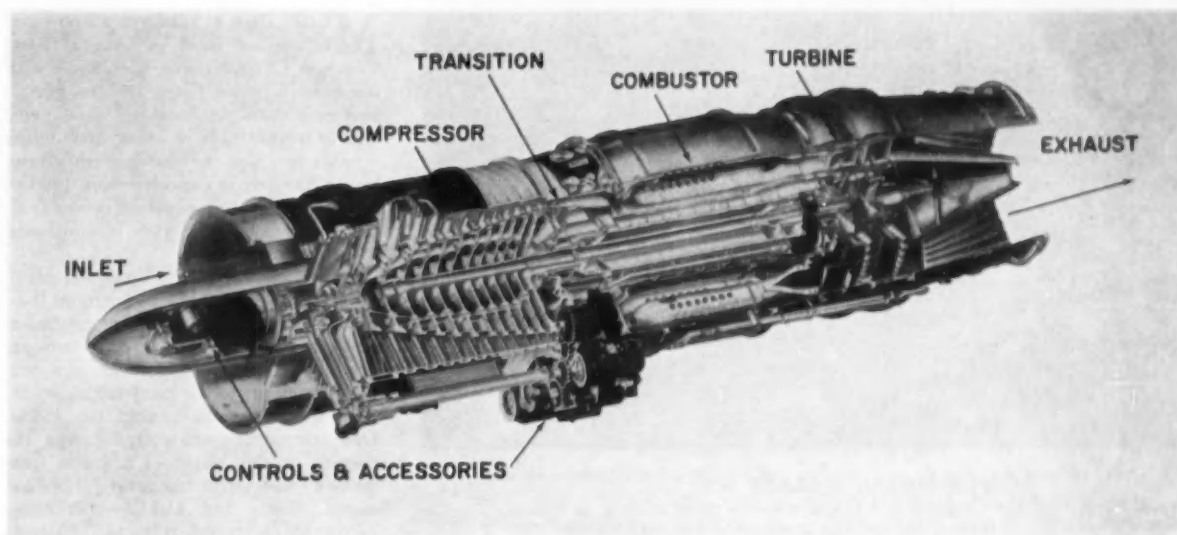
Sketch of one of the combustion test facilities (bottom). Air is delivered to the combustion chamber through a regenerative heat exchanger. Combustion discharges help heat the air to temperatures as high as 950°F, simulating actual compressor discharge temperatures. Note the relatively small size of the test chamber compared to the plenum chamber just ahead of it. At the test section inside one of the combustion cells (below), technicians make final adjustments and instrumentation connections prior to a trial. The component being tested is within the casing to the rear of the plenum chamber. Refrigerated air at reduced flows, and heated and refrigerated fuel are also available to simulate flight conditions. Note the roller supports to allow for thermal expansion of the heated parts.



### Air Supply Vital to Testing

The test cells require air at varying temperatures, pressures and volumes. In the combustion cells, incoming air, delivered through regenerative heat exchangers, is heated by combustion gases to temperatures as high as 950°F to simulate compressor discharge conditions encountered in actual flight. Tests are conducted over a range of flows from 9 to 100 pounds (weight) of air per second at pressures from 1/20 atmosphere at reduced flows, up to 300 psi. Turbine testing, wind tunnel and other facilities make corresponding demands for air.

To meet these requirements, five multi-stage Ingersoll-Rand turbo-compressors have been installed to provide the main air supply. They deliver air to the test chambers over a wide range of conditions. Pressures of up to 20 atmospheres, or about 300 psi, can be sup-



#### JET POWER PLANT

This cut-away view of a J73 engine shows some of the engine components tested at Evendale. Complete testing fa-

cilities make it possible for engineers to evaluate advanced component designs before the engines are built.

plied at flow rates of up to 100 pounds (weight) of air per second. Pressures as low as 1/20 atmosphere, simulating flight conditions at approximately 70,000 feet, can also be obtained by using the compressors as exhausters at reduced flow rates. The units can be run individually, in series or in parallel to produce desired conditions. Each is equipped with bypass valves to recirculate air if large quantities are not required. Each also has variable inlet guide vanes for further control of air flow and after-coolers to cool air before it is delivered to the next compressor or to the test cells. Two of the machines discharge at 34-psi, two at 120-psi, and the fifth at 300-psi pressures. They are driven through speed-increasing gears by five synchronous constant-speed motors, and require 27,000 hp to operate at maximum output.

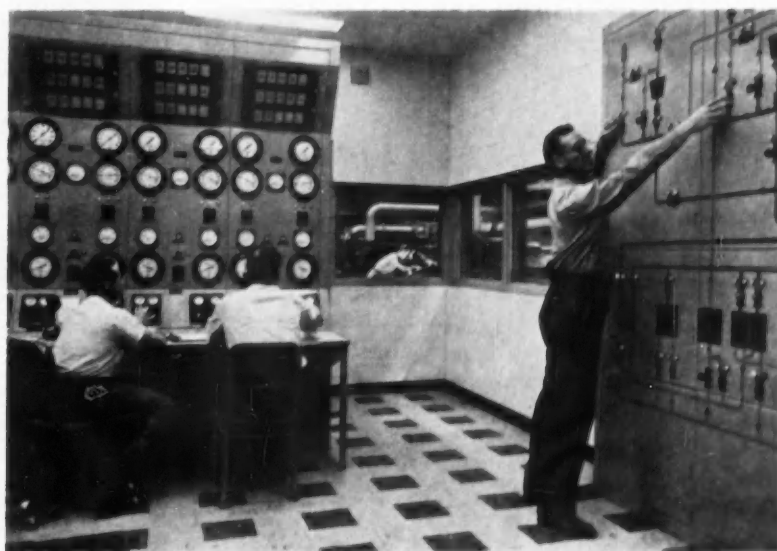
An auxiliary or shop air supply is furnished at a constant pressure of 100 psi by two reciprocating compressors. These provide a maximum of 12 pounds (weight) of air per second to the test cells for use as a secondary supply, as well as for equipment control purposes. An additional reciprocating compressor provides a high-pressure auxiliary supply, furnishing up to 6 pounds (weight) of air per second at pressures up to 350 psi.

Whenever the main air supply compressors are to be operated at maximum output, personnel in charge are careful to check other facilities within the plant to avoid peak demand charges for power. At top speed, all five electric motors require 27,000 kva (kilovolt-ampere), or approximately the amount of current needed for residential and commercial requirements in a city of about 40,000 people.

Engineers regulate the air flow to test cells from a central control room adjacent to the compressors. They are in constant contact by telephone with personnel at these cells, and reduce or increase pressures or volumes of air at the direction of the engineers conducting the tests. A lighted panel in the control room schematically shows all interconnecting compressor and cell piping, and

provides a visual picture of the path taken by air from compressors to cells. Special lighting indicates the operation of valves and helps to assure the integrated operation of all tests.

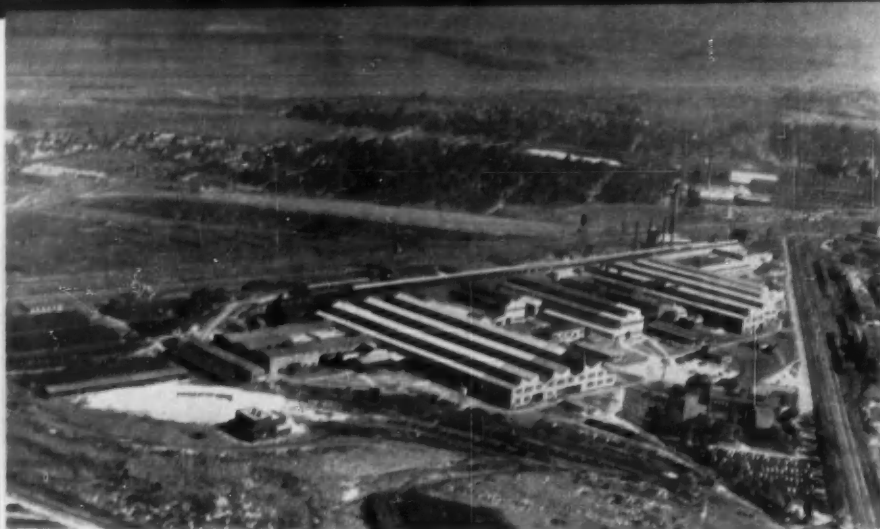
The jet engine testing facilities at Evendale use prodigious quantities of air, and G-E engineers refer to the air supply as the heart of the applied research activity.



#### CONTROL ROOM

The compressor control room is shown above. The operators seated at the control panels at the left regulate the output of the compressors and dispatch air to the various test cells at the direction of personnel conducting the tests. Communication between the control room and air-using facilities is by telephone. The panel at the right schematically indicates the path taken by air from compressors to test cells, and has lights that show whether valves are open or closed. Portions of several of the motors used to drive the compressors can be seen in the background through the windows.

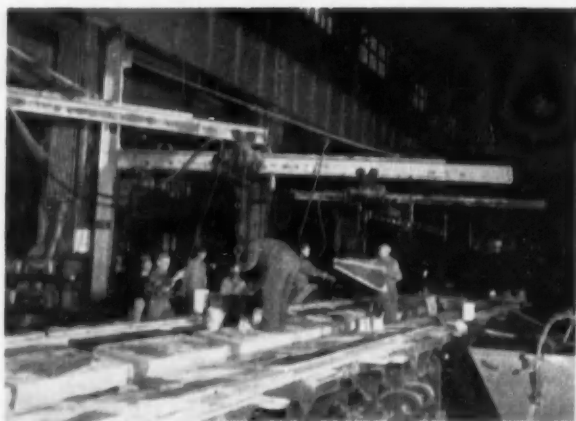




#### COMMONWEALTH PLANT SITE

General Steel Castings Corporation's Commonwealth plant (above) is located at Granite City, Ill. It is here that the firm produces large, intricate steel castings for railroad equipment that is used around the world.

More than 100 Ingersoll-Rand  
air hoists used in General  
Steel Castings Commonwealth  
plant give precise core  
handling and low maintenance



#### POSITIONING SAND CORES

Looking down one of the bays in the Commonwealth plant, two 4000-pound pneumatic hoists can be seen in operation. They are positioning sand cores in a large mold for a railroad freight car underframe.

**M**ORE than a hundred air-powered hoists are used in General Steel Castings Corporation's Commonwealth plant in Granite City, Ill., to permit precise control in handling sand cores and in a multitude of other demanding operations. Use of these Ingersoll-Rand hoists, ranging in capacity from 1000 to 10,000 pounds, has increased production, promoted product quality and reduced maintenance costs.

The plant, in the St. Louis industrial district, has been notable for more than half a century, pioneering in the design and production of large and intricate products in cast steel. Here are produced castings for railroad rolling stock, used in 54 nations around the world. One spectacular achievement was the casting, in one piece, of a steam locomotive bed with integral cylinders, steam chests and saddle—still being produced for roads overseas. Current products include car and locomotive trucks, flat car and pulpwood car underframes, and major cast steel parts for diesel, gas turbine and electric locomotives.

A 375-foot foundry building erected in 1904 has grown through the years until today it is 1975 feet in length.

## AIR HOISTS PERM



#### LIFTING OPERATION

Shown (above) is a 10,000-pound-capacity Ingersoll-Rand air hoist lifting a wagon with 100-pound bags of heavy zircon sand to the second floor storage area. Just a partial load is illustrated.



Needless to say, production methods and equipment have kept pace. The plant can produce 4000 tons of finished castings, machined and ready for application, every month.

One of the advances has been in the movement of materials and parts, notably the placement of sand cores in large intricate molds. Hundreds of cores are assembled to make a single huge casting in much the same way as a giant jigsaw puzzle. Individual pieces may weigh anywhere from 5 to 2500 pounds. Originally, these cores were handled with manually-operated hoists, a slow process of translating muscle into movement through the mechanical advantage of chain and pulley.

First step toward the application of modern power to this job was the introduction of electric-powered hoists in some departments. Two principal problems developed: the number of speeds possible with these units was limited, and the requirement of precise control in handling of the cores was nearly impossible. A swift, 4-inch drop, when a slow ½-inch one is desired, could mean the damaging of cores, and subsequent patching or replacement.

To achieve production speed without

sacrificing control precision, the company installed I-R air hoists in one department in 1941 to replace hand hoists. (Compressed air for the plant is supplied at 100-psi pressure by seven compressors, five of which are electric motor-driven Ingersoll-Rand units.) Experience with the initial hoist installation led to expanded use throughout the plant. It was found that the pneumatic units have unlimited speed range because control is effected by throttling the flow of compressed air. Thus, it is now literally possible to lower a load a fraction of an inch. This control feature is valuable in positioning cores in the mold, and is equally useful in easing a core box off a completed sand core. Dozens of other load-handling jobs in the foundry, core room, finishing department and blacksmith shop are similarly performed quickly, safely and without damage.

Experience in the Commonwealth foundry has revealed other characteristics of the air hoists. If used to handle a load beyond its capacity, a pneumatic unit simply will stall and refuse to lift it. It won't drop a load. It can't burn out. The fact that an air motor can stall under overload without burning out or suffering damage of any kind is an im-

portant factor in reducing maintenance costs. It also avoids interruption of production which would otherwise be necessary while a hoist was repaired or replaced.

In the foundry building, every work bay in use is equipped with an air hoist. Each rides a 23-foot steel beam pivoting on a vertical structural column. Some of the larger ones have two air motors: one to lift the load, the other to move the hoist laterally along its monorail. There are three 5-ton units in service: one lifting loads of heavy sand to storage, another for roll-over and the third for unloading core chills and bars in the blacksmith shop. Special long-lift air hoists are suspended—some 60 feet above the floor—from monorails attached to roof trusses to handle parts for maintenance of big electric traveling cranes. Most are of 1000-, 2000- or 4000-pound capacity.

The primary interest, however, is in the ease and flexibility of control—the ability to move, smoothly and precisely, a load as swiftly or as slowly as is desired. These, according to General Steel Castings engineers, are factors that promote high production rates and product quality.

## IT PRECISION CONTROL



**UNDERFRAME PRODUCTION**

A pneumatic hoist is used (above) to place hundreds of sand cores in a huge mold for a large pulpwood car underframe. Ease and flexibility of air hoist control are of primary interest to production men.



**LOADING CORE BOXES**

An Ingersoll-Rand 4000-pound air hoist is used to load core boxes on a plate. Precise control possible with air hoists is one factor in the facility's excellent safety and quality record.

## This and That

### Do-it-Yourself Foundries

The era in which we are living may well be termed the "Do-It-Yourself Age," when the number of items of this nature that are now on the market are considered. One of the most recent arrivals on the scene is a home casting kit that is being marketed by a Kansas manufacturer. With it, experiments can be made with metal and alloy combinations right in the basement of one's home. Costing less than \$50.00 each, a set includes furnaces, blowers, crucibles and accessories. Operation utilizes natural, manufactured or LP gas, and three models are available for producing 1 1/2- to 6-pound castings.

\* \* \*

### Delayed Aging Process

In the production of jet airliners, many unforeseen problems have developed, and as a result many ingenious solutions have been found. Most recently, the answer to a perplexing metal-working question was refrigeration. Aluminum skin for the wings of Douglas Aircraft Company's new DC-8 is cut from sheet rolled on a tapered sheet mill at the Davenport, Iowa, works of Aluminum Company of America. An age-hardening type of aluminum alloy was specified. At room temperature, sheet rolled from such a material slowly becomes harder and stronger. The advantage is that the aluminum can be machined and fabricated while soft. It will then strengthen itself at room temperature without the need for heat-treatment or tempering. How could the tapered sheet be kept from aging during the week-long trip from Iowa to California, where the ma-

chining would take place, was the problem. Alcoa found the answer in a practice followed with aluminum aircraft rivets. The aging process was suspended by packing the aluminum sheet in dry ice to provide a sub-zero cross-country ride. On arrival, the material was removed from the deepfreeze, cut to size and fabricated, and then allowed to resume its natural aging, strengthening procedure.

\* \* \*

### Lighting With tin Sandwiches

A new method of lighting rooms is being developed and is called "electroluminescence." Thin, luminous panels, which will be the surfaces of the room, will emit light of almost any color or brightness, it is reported. The system can be best likened to a sandwich, in which a pair of transparent electrodes are the slices of bread and a paper-thin layer of a substance with the property of emitting light when exposed to certain electric fields, the filling. The outer layers, made of fine wire meshes or films of tin oxide, will act as a conductor. Eventually, after certain inefficiencies of output of lumens of light per watt of electricity consumed are eliminated, walls, ceilings and draperies may glow.

\* \* \*

### Road Testing Neoprene

Highway engineers in five states are cooperating with chemists from E. I. du Pont de Nemours & Company in testing asphalt containing neoprene synthetic rubber as an improved material for "surface treated" roads. If these field tests sub-

stantiate 7 years of laboratory investigations, neoprene may be used to lengthen road-surface life and at the same time provide safer driving conditions and cut maintenance costs. The synthetic rubber is mixed in specific proportions with standard asphalt, and the surface material is applied with conventional equipment. The test material is laid side-by-side with untreated asphalt so that both surfaces will be exposed to identical wear. In this way, regular inspections of the strips will give accurate comparisons. It is expected that neoprene will add elasticity to the asphalt, holding the stone chips in place longer. In addition, it is hoped that it will provide better traction, an important safety factor.

\* \* \*

### Japan's Subaqueous Tunnel

Soon, vehicles and pedestrians will be able to travel from the Japanese mainland to Kyushu, the southernmost island of the country, by going through a double-deck tunnel on the Kammon Highway. The upper portion of the passage will accommodate cars and trucks, and the lower section is reserved for people. Elevators at each end provide access. It is said that the structure, slightly more than 2 miles long, is the second longest under-water highway in the world. (The longest is the Mersey Tunnel in Britain with a length of 2 1/2 miles.) Construction on the Kammon began in 1939, was interrupted during the Second World War, and is scheduled to be finished in March of next year. When completed, it will link the industrial and mining centers of Moji and Shimonoseki. Costs, it is estimated,

## RIVER READY

A SECTION of 34-inch-diameter pipe, 357 feet long, is shown here ready to be pulled across the Red River south of Winnipeg, Man., in the Trans-Canada Pipe Line's natural gas line from Alberta to eastern Canada. The 40-foot lengths of pipe have been welded into the long section, it has been cleaned and primed, coated and wrapped, protected with rock shields and wooden slats and encased in 88 concrete river weights, each weighing 6000 pounds. The weights are used to hold the pipe in the ditch below the river bed. Because the pipe now weighs 1100 pounds per foot, air-tight steel floats are attached to help lighten the section as it is pulled into the water. Later the floats will be released and retrieved to be used when the next section, 314 feet long, is pulled across.



will reach the \$14 million mark. The Japanese Highway Corporation anticipates that the tunnel will carry 2000 vehicles every hour, and a like number of pedestrians, over a similar time span, on the lower deck.

★ ★ ★

**New Use for Lignin** Experiments by the Canadian Government and private research agencies have shown that lignin—the substance that nature produces to hold wood fibers together—can be used to give longer life to pneumatic tires as well. This is particularly true of large-diameter ones used on tractors and military vehicles. The lignin used in these tests is a by-product of alkaline pulp manufacture, and as such, it was noted in a report, “has a production potential in North America of 8 million tons a year.” According to the National Research Council, testing shows that tires with synthetic rubber treads that have been reinforced with lignin showed 15 percent more resistance to wear than conventional models. Because synthetic rubber, under present conditions, becomes too hot at high speeds, the larger the tire, the more natural rubber that must be used in its construction. When synthetic rubber is reinforced with lignin, however, it develops less heat than without it, and the success of these experiments suggests that an all-synthetic, large-diameter tire may eventually evolve.

★ ★ ★

**Moving the Thermal Barrier** Lithium, lightest of all the metallic elements, has proved to be the key to a new aluminum aircraft alloy that maintains high strength at elevated temperatures. The discovery, representing a major scientific breakthrough in light-alloy research, was announced by Aluminum Company of America early last month. It is said that the material will maintain high strength up to 400°F. This means that the thermal barrier, that has heretofore threatened aluminum applications in supersonic aircraft, has been pushed ahead by more than 100°F. Jet-propelled aircraft, traveling 1600 mph at operating altitudes, develop skin temperatures of approximately 350°F. Conventional aluminum alloys used begin to lose physical properties in the 250°-350°F range, limiting their usefulness to speeds of less than 1300 mph. Alcoa's research with lithium developed the fact that the rare-earth element not only serves to maintain aluminum's strength at high temperatures, but also produces the remarkable effect of increasing the modulus of elasticity of aluminum alloys. (Modulus of elasticity is a measure of the



#### THE DRILLER

Amidst a beautiful setting in Brookgreen Gardens, founded in 1932 near Georgetown, S.C., has been created an open-air museum of sculpture, native plants, shrubs and wildlife. In the quarter century since the property was purchased by the Archer M. Huntingtons and made into a public garden, the natural beauty of thousands of acres has been enhanced by the advantageous placement of appropriate works representative of American sculptural history and by the planting of hundreds of plants and shrubs indigenous to the region. Among the more than 200 sculptured figures of legendary characters and of birds and animals, one is outstanding for the practicality of the activity it depicts. “The Driller,” by Mahonri Young, pictured above, represents a fine figure of a man at work with a paving breaker. Executed in bronze, the highlights of its well-preserved finish (washed, and rubbed with a mixture of beeswax and turpentine) give one a feeling of motion only temporarily arrested and reaffirm the fact that beauty is to be found in all phases of living.

deflection of a material under load, and is of prime importance in aircraft design.) The lithium content of alloy X2020, as it is called, has improved the modulus factor by some 8 percent over standard aluminum alloys for aircraft. One factor in using aluminum, instead of stainless steel or titanium, is that of weight. X2020 is so lightweight that it will reportedly float on water.

★ ★ ★

#### Water-Shaped Stone

High on a mountain side in Mexico lies the temple of Malinalco. It has long remained a mystery as to how such monumental structures were built without the aid of metal stone-cutting tools or modern means of moving them into place. J. Ogden Outwater, Jr., an engineer at the University of Vermont, after studying three such engineering marvels, believes that the ancient Mexicans took advantage of the peculiar qualities of the stone

with which they worked. The temple of Malinalco is hewn out of a mountain that is made almost entirely of volcanic ash containing clay. The substance absorbs large quantities of water, and when so saturated, becomes soft and workable. When it dries, it regains its rock-like qualities. Channels leading from a spring further up the mountain side from the construction site to the various parts of the temple were discovered. It is Outwater's opinion that the water was diverted into the area being worked, contained there until the stone had become permeated, and drained. Wooden or stone mattocks could then be used to hack out the rock while it was soft; and rolling-pin-shaped instruments, sharpened on one end, were used to finish the construction. The main temple consists of a central chamber, decorative statues and staircases. It is estimated from the size of the ledge on which the workmen had to stand, that only about 50 men could work at a time, and that the building of the monument took 10 years.



#### A STREETCAR NAMED HOME

A modern 3-bedroom home is shown at the left. It has a different appearance, to say the least. A discarded streetcar was torn apart to make sides of the living room and sun porch.

## OLD STREETCARS NEVER DIE

Carey Holbrook

OLD street cars never die. A long time ago the city bus drove the iron-wheeled passenger carriers off the streets of most American towns. They weren't all disposed of; some simply were moved out of traffic jams and now turn up in the strangest places.

Most of these relics of a bygone era finally start a new life as a chickenhouse, a play house for children, or some kind of a misshapen eyesore roosting on the rear of a lot. But there is one that did not come to this end. Old Number 836 (she formerly ran the streets of Denver, Colo.) found herself set in the middle of a modern 3-bedroom home at 1330 Twelfth Street, Canon City, Colo. No eyesore, it is worth about \$15,000 if it were to be put on the market. It was built by C. E. Rathburn. Of course the builder took off her wheels, sawed her in two, and got her in shape so she would fit into his house. But the sides and ends are all in one piece, and there is no doubt when you look at the house that part of it was once a streetcar.

Some 15 years ago, Rathburn moved into Canon City with the idea that he would settle down in the quiet town and do a lot of plain and fancy resting. Originally from Ohio, he had a busy life. For 25 years he was a builder of homes in Denver. Then, when the war came along and no home-building-material priorities were to be had, he traded nine half-finished dwellings for a ranch on Bear Creek, 22 miles south of Steamboat Springs. He had 1300 acres there and ran 300 head of cattle. After a while he acquired a spread of 5000 acres close to Guffey and really entered the cattle business. When he thought he was getting too old to straddle a horse, he sold his ranch holdings and moved into Canon City to rest.

He started on his long vacation by buying 14½ acres in Lincoln Park, a

rich agricultural district where fruits and vegetables are grown for wholesale. Then he acquired 50 or 60 acres more on the north edge of town and set out a young orchard. Soon after, someone in Denver offered him a bargain lot of discarded streetcars. He bought eight and had them trucked into Canon City.

By this time he was also in the turkey business on his Lincoln Park acreage so he converted some of the old cars into brooder houses. He moved three or four to the north side plot and made bunk houses out of them. One or two were sold, however Number 836 was retained. He soon developed other plans for it.

Rathburn, who is now 79 years old, decided that a good solid streetcar, with all the windows intact, deserved to be used for a better purpose than a nursery for turkeys. He thought it would do much for a modern dwelling if put in the right place. Since he was only 77 years old at the time, he could see no

reason why he shouldn't do most of the work himself. Except for some helpers to do the heavy work, he did just that.

The main dining and living room is 16x36 feet, with a fireplace in one end. The ceiling is curved, with part of the roof supports of the streetcar used as ceiling beams. The sides of the living room are made from the sides of the car, and each has fifteen windows. The curved front of car 836 has been adapted to a sun porch which is 12x20½ feet and opens into the living room.

The kitchen is 12x18 feet. There are three bedrooms, one of them 14½x17 feet, and the other two a little smaller. There are, of course, closets and halls, a full basement and big bath.

In short, streetcar Number 836 that formerly clanged her way along in Denver, is now a most attractive part of a thoroughly modern dwelling, planned and built by a 79-year-old gentleman while he was resting.



#### DENVER ANTIQUE

C. E. Rathburn is shown in this photograph with one of the discarded streetcars he bought when the city of Denver dispensed with their services. A car similar to this was used in building his home.



# EDITORIAL

## Industrial Isotopes

ACCORDING to a recent report by the Atomic Energy Commission, industries utilizing radioactive isotopes are saving an estimated total of \$406 million a year. That figure is up from \$100 million in 1953, from \$200 million in 1954 and from \$390 million a year ago. In all cases the figures given are the mean of a carefully estimated range of values. For example, the AEC high estimate for the recent report was \$500.3 million; the low, \$312.1 million. AEC commissioner Dr. W. F. Libbey, in a September 17 speech to a UNESCO radioisotope conference in Paris, said that it is reasonable to speculate that industrial savings might reach \$5 billion within 4 to 5 years.

Of the 288,000 manufacturing establishments in the United States, only 1667 were using radioisotopes—only 0.6 percent. On the other hand, half of the 500 largest manufacturers are making use of radioactive materials in one form or another. It is on the assumptions that a great many additional users will come along and that those now applying the materials will expand their use of them, that the Commissioner bases his estimate of future savings. As of August 1, this year, the AEC had issued 4182 licenses to organizations for the use of radioisotopes. Industrial licenses were second only to hospital and private physician permits, the latter totaling 1754. It is of interest to note that few industrial concerns discontinue using isotopes once started; the total of such "drop outs" constitutes less than 2 percent of the users. Indeed, in most cases those firms relinquishing their permits shifted their radioisotope investigations to consulting laboratories which, by their nature, have superior facilities.

The petroleum industry alone is estimated to save at least \$141.8 million through use of isotopes; the tobacco industry, \$42.7 million, by utilizing cigarette density gauges; paper mills, \$23.1 million, through use of thickness measuring devices; and metalworking plants, \$18.5 million, also by applying radioisotope thickness gauges.

Using radioactive isotopes can be expensive, depending on the type of equipment required, but most users feel that capital expenditures are quickly amortized. Isotopes themselves are costly at the present time. They are sold in curie units, curie values being a means of relating the strength of the radioactive emission to that of one gram of radium. Cobalt<sup>60</sup> costs about \$5 per curie; carbon<sup>14</sup>, \$22,000; iodine<sup>131</sup> \$400; and cesium<sup>137</sup>, \$10 per curie. The AEC expects mass production of isotopes to bring the cost down considerably. Estimates are available giving the absolute minimum prices that might be expected if demand warranted large-scale production. Cobalt<sup>60</sup>, for example, could sell for as little as \$0.06 per curie; carbon<sup>14</sup>, \$110; iodine<sup>131</sup>, \$0.0004; and cesium, \$0.30 per curie. The prices given in

both cases are based on a cost of \$30 per gram for plutonium.

A new industry has been born because of the continuing, and rising, demand for radioisotopes. Private processing plants obtain bulk quantities of radioactive isotopes from the AEC, encapsulate them in smaller packages and distribute them, not only to industries, but other users as well. As demand grows, say AEC officials, the role played by such private industries will become more and more important. Over the years the AEC has noticed a trend in the quantity—curies—of isotopes being used by industry. Whereas in the 1946-49 interval the average establishment was making use of only micro- or millicurie amounts, many firms today are utilizing kilocurie quantities. Indeed, some industrial radiation sources of as much as 65,000 curies are noted.

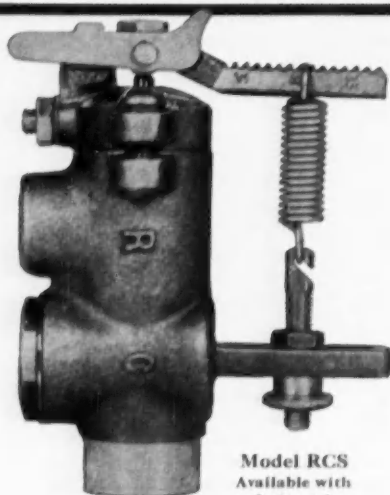
Another, and somewhat strange occupation has come out of the isotope program. It is called isotope farming or isotopic biosynthesis. There is a demand for certain radioactive organic isotopes that can be obtained at present only by growing them. Growing an organic radioisotope consists essentially of first selecting a plant that normally produces the organic substance desired and then feeding it radioactive isotopes of some of the materials needed in the manufacture of the organic compound. The plant does the work, manufacturing the isotopic organic chemical and storing it for extraction by common organic chemical processes. This method will remain of importance until organic chemists can learn to synthesize the required substances in their laboratories. It may even be that isotope farming can show the way to laboratory synthesis by permitting the scientists to follow the various reactions with the aid of radiation-detecting instruments.

What the future may bring in the way of more applications for radioisotopes is highly speculative, of course, but scientists have indicated a few that may develop rather quickly. In the process industries, for example, they point out that short-lived sources of radioactivity might be added to intermediate product streams, and the emissions therefrom used to control the course and extent of subsequent chemical reactions. For industries dealing with hydrocarbons, which would, of course, include the vast petroleum and petrochemicals fields, there lie great possibilities in the use of both radiocarbon and radioactive hydrogen. For example, certain constituents of crude oil could be isotope labeled prior to passing through a refinery. The emissions therefrom could be used to follow the course of reactions, and perhaps even to automatically control them. Such uses of isotopes, the scientists say, would have no ill effects on humanity because of the extremely small amounts required.



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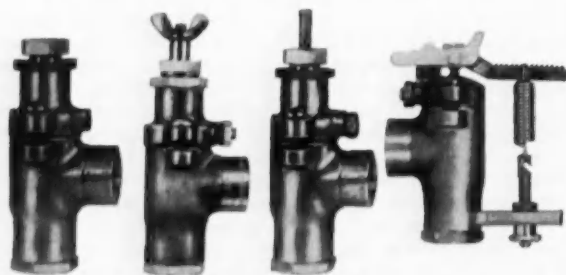
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#### BULLDOG GRIP—FEATHER TOUCH

Air in a device developed by Presray Corporation has gone to work in moving bulky fragile products. Called Pneuma-Grip, it consists of a steel supporting ring, or frame, lined with a pneumatic rubber "tire." It is hung from a regular hoist by a wire rope sling, positioned around the object to be transported and inflated with air from shop lines to a pressure of from 5 to 25 psi. The tire grips the object firmly, yet gently, and movement is effected by the hoists. A push-pull air valve controls the flow of compressed air in and out of the tire. As illustrated, one man is handling an abrasive wheel. Before adopting this air aid, movement of a wheel 48 inches in diameter and weighing 600 pounds from forming presses to kiln trucks required two to four men. Because the device can be shaped to fit any product, wide potential for it exists in handling such products as appliances, foundry cores, ceramic parts, radio-active materials, fiber drums, newsprint and furniture.

### BRITISH PNEUMATIC TIRE AUTOMATION

ONE of the early contributions of The Hymatic Engineering Company, Ltd., Redditch, England, is its Tubeless Tire Inflation Machine, now being used by many motor manufacturers in Great Britain.

By enabling an operator to inflate a tubeless tire to within 1 psi of the manufacturer's recommended pressure in approximately 6 seconds, the unit eliminates delays in modern car manufacturing techniques. Thus, wheels with inflated tires can be supplied to production lines as quickly as they are required, with considerable savings in man-hours. Formerly each wheel and tire had to be held by some mechanical means that would keep the tire on the rim before it was air filled.

The Hymatic unit consists essentially of a steel frame with upper and lower platens situated in the center, between which the wheel and tire are inserted. A rubber sealing ring is embedded in the lower platen while the upper one is hol-

low so that air can be passed through it into the tire. This ring is necessary because of the wide variety of tire sizes that have to be inflated. In the United States similar equipment is in operation, but since each manufacturer uses only one wheel size, the design is comparatively simple.

With the tire loose on the rim, the

wheel is laid on the lower platen so that its underside rim edge is sealed by the rubber ring. The operator then presses the start button. Thereafter, the complete sequence is automatic. Air is admitted to an accumulator, situated at the side, displacing oil from the other side through a stop valve into the raising cylinder in the machine column beneath the lower platen.

The platen rises, sealing the upper tire wall against the rounded edge of the top platen. At the top of the stroke a sequence valve operates a small ram to close the oil stop valve and at the same time opens the air admission valve to the upper platen.

Air flows through and fills the tire and top platen until a preset pressure, several psi above the ultimate pressure of the tire, has been reached. Then a second sequence valve closes the admission valve and opens the oil stop valve. Release of the oil column allows the lower platen to fall rapidly, producing an "explosion" of the tire into the wheel where it fits tightly against the rim. The air expansion in this phase of the sequence reduces the tire pressure to the correct figure. The operator then removes the wheel.

Feeding the machine is facilitated by its open design. Roller conveyors can be arranged to carry uninflated wheels to within a few inches of the platens. Thus, all the operator has to do is to merely push the wheel onto the machine and shove it away onto another conveyor, on the other side, after the inflation cycle.

When required by manufacturers, Hymatic can produce the machine with all hydraulic and compressed air components duplicated. In the event of a failure, the operator simply switches over to the standby system while repairs are carried out.

A further development of this machine has recently been put into operation at Vauxhall Motors, Ltd. Here the inflation device forms part of a 15-foot-diameter, 3-station circular transfer machine that first fits, and then inflates, the tires. The compressed air supply not only inflates the tires, but is also used for the feed and transfer motions.

### SAVING WITH AIR POWER

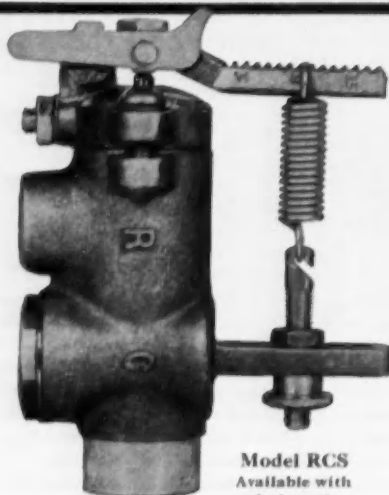
#### Vibrators Cut Boat Trips

IN transporting alumina, a Canadian company once made three more boat trips per year than they do now. They realized that if they could make the substance settle more in the holds of the ships, fewer trips would be required to transport the same amount. Vibrators were needed. Electric units were tried first, but the alumina entered the bearings and caused excessive maintenance

problems. Air power finally solved the problem. Ingersoll-Rand Company's Size 2V vibrators were tested. Their design was such that the material did not enter them, thus reducing maintenance costs. The volume of alumina settled 16 percent more than before. The company purchased 48 units, and the number of required annual trips was reduced by three, representing a saving of \$300,000.

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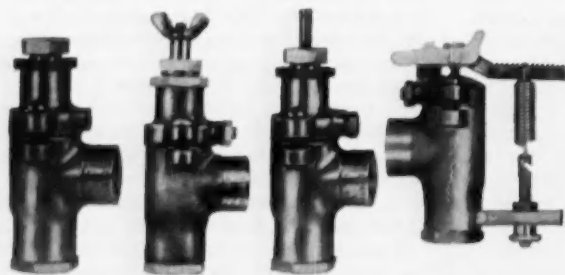
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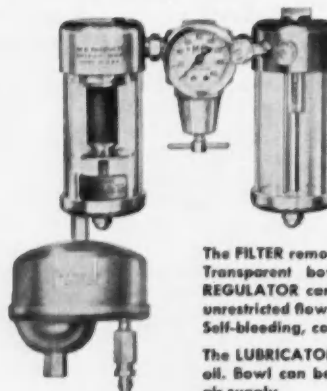
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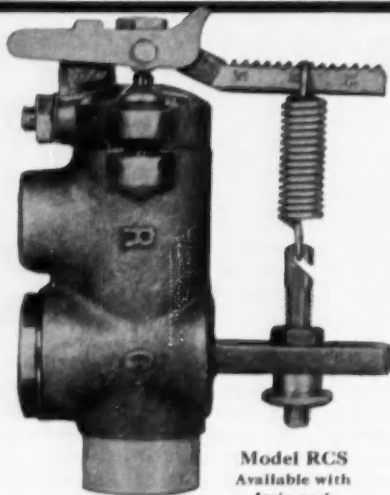
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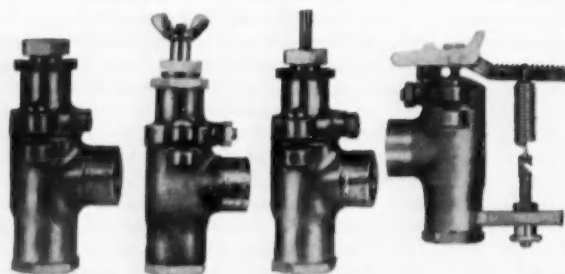
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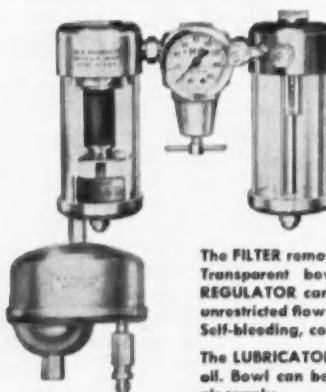
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#### BULLDOG GRIP—FEATHER TOUCH

Air in a device developed by Presray Corporation has gone to work in moving bulky fragile products. Called Pneuma-Grip, it consists of a steel supporting ring, or frame, lined with a pneumatic rubber "tire." It is hung from a regular hoist by a wire rope sling, positioned around the object to be transported and inflated with air from shop lines to a pressure of from 5 to 25 psi. The tire grips the object firmly, yet gently, and movement is effected by the hoists. A push-pull air valve controls the flow of compressed air in and out of the tire. As illustrated, one man is handling an abrasive wheel. Before adopting this air aid, movement of a wheel 48 inches in diameter and weighing 600 pounds from forming presses to kiln trucks required two to four men. Because the device can be shaped to fit any product, wide potential for it exists in handling such products as appliances, foundry cores, ceramic parts, radio-active materials, fiber drums, newsprint and furniture.

#### BRITISH PNEUMATIC TIRE AUTOMATION

ONE of the early contributions of The Hymatic Engineering Company, Ltd., Redditch, England, is its Tubeless Tire Inflation Machine, now being used by many motor manufacturers in Great Britain.

By enabling an operator to inflate a tubeless tire to within 1 psi of the manufacturer's recommended pressure in approximately 6 seconds, the unit eliminates delays in modern car manufacturing techniques. Thus, wheels with inflated tires can be supplied to production lines as quickly as they are required, with considerable savings in man-hours. Formerly each wheel and tire had to be held by some mechanical means that would keep the tire on the rim before it was air filled.

The Hymatic unit consists essentially of a steel frame with upper and lower platens situated in the center, between which the wheel and tire are inserted. A rubber sealing ring is embedded in the lower platen while the upper one is hol-

low so that air can be passed through it into the tire. This ring is necessary because of the wide variety of tire sizes that have to be inflated. In the United States similar equipment is in operation, but since each manufacturer uses only one wheel size, the design is comparatively simple.

With the tire loose on the rim, the

wheel is laid on the lower platen so that its underside rim edge is sealed by the rubber ring. The operator then presses the start button. Thereafter, the complete sequence is automatic. Air is admitted to an accumulator, situated at the side, displacing oil from the other side through a stop valve into the raising cylinder in the machine column beneath the lower platen.

The platen rises, sealing the upper tire wall against the rounded edge of the top platen. At the top of the stroke a sequence valve operates a small ram to close the oil stop valve and at the same time opens the air admission valve to the upper platen.

Air flows through and fills the tire and top platen until a preset pressure, several psi above the ultimate pressure of the tire, has been reached. Then a second sequence valve closes the admission valve and opens the oil stop valve. Release of the oil column allows the lower platen to fall rapidly, producing an "explosion" of the tire into the wheel where it fits tightly against the rim. The air expansion in this phase of the sequence reduces the tire pressure to the correct figure. The operator then removes the wheel.

Feeding the machine is facilitated by its open design. Roller conveyors can be arranged to carry uninflated wheels to within a few inches of the platens. Thus, all the operator has to do is to merely push the wheel onto the machine and shove it away onto another conveyor, on the other side, after the inflation cycle.

When required by manufacturers, Hymatic can produce the machine with all hydraulic and compressed air components duplicated. In the event of a failure, the operator simply switches over to the standby system while repairs are carried out.

A further development of this machine has recently been put into operation at Vauxhall Motors, Ltd. Here the inflation device forms part of a 15-foot-diameter, 3-station circular transfer machine that first fits, and then inflates, the tires. The compressed air supply not only inflates the tires, but is also used for the feed and transfer motions.

### SAVING WITH AIR POWER

#### Vibrators Cut Boat Trips

IN transporting alumina, a Canadian company once made three more boat trips per year than they do now. They realized that if they could make the substance settle more in the holds of the ships, fewer trips would be required to transport the same amount. Vibrators were needed. Electric units were tried first, but the alumina entered the bearings and caused excessive maintenance

problems. Air power finally solved the problem. Ingersoll-Rand Company's Size 2V vibrators were tested. Their design was such that the material did not enter them, thus reducing maintenance costs. The volume of alumina settled 16 percent more than before. The company purchased 48 units, and the number of required annual trips was reduced by three, representing a saving of \$300,000.



# What is Your PIPING PROBLEM?

Air? Water? Drainage?  
Dredging? Ventilating? For any  
services like these, it will pay you  
to check into NAYLOR spiralweld pipe  
performance. You'll like the ease of handling  
and installing this light-weight pipe. You'll find  
that its spiral lockseam structure adds strength and  
safety you wouldn't expect from a light-wall pipe. And  
with the one-piece NAYLOR Wedgelock coupling, you'll be  
able to make up lines faster and more economically. For details,  
write for Bulletins No. 507 and No. 513.

# NAYLOR

**NAYLOR PIPE COMPANY**

1246 East 96th Street, Chicago 19, Illinois

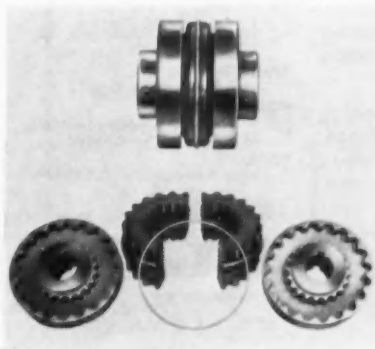


Eastern U.S. and Foreign Sales Office:

60 East 42nd Street, New York 17, N. Y.

## Industrial Notes

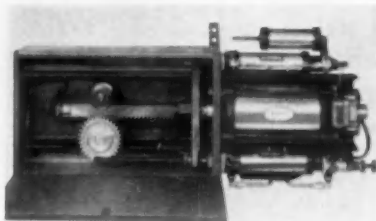
For use wherever mechanical power is to be transmitted, Sure-Flex flexible couplings have only three basic parts: two hub flanges and a 2-piece rubber sleeve. The internal and external teeth of the flexible sleeve mate with the flange hub teeth and lock tightly under torque load without clamps or screws. There are no rubbing or wearing surfaces and hence no need for lubrication. All shock vibrations are said to be absorbed by the coupling sleeve. This high torsional flexibility—approximately 15 degrees at peak torque—provides smooth power transmission. According to T. B. Wood's Sons Company, the manufacturer, the units are designed to



tolerate, without wear, internal abuse or high resisting forces, angular misalignment of up to 1 degree, parallel misalignment of from  $\frac{1}{32}$  to  $\frac{1}{16}$  inch, depending on shaft measurement, and free end-float up to  $\frac{1}{8}$  inch, depending on size. Angular or parallel misalignment does not generate unbalance or pulsations since all flexing takes place within the rubber sleeve. Shafts and bearings last longer because no destructive overhung loads are imposed at any load through misalignment.

*Circle 18 on reply card*

Hy-Torque has been added to The Bellows Company's line of Controlled-Air-Power self-contained work devices. It is a rugged, heavy-duty unit designed primarily to power the feed on multiple drilling applications. The basic unit consists of a steel rack that drives a pinion gear mounted on a shaft with a hub as the drive unit. The 3000-inch-pound maximum torque delivered at the hub may be applied to any cross-feed or driven shaft for rotational or linear movement. Four standard models provide a 170-, 255-, 340- or 425-degree rotation choice of the 4-inch pitch diameter pinion gear. A  $4\frac{1}{2}$ -inch-bore motor advances the rack with a thrust fifteen times that of the applied air line pressure. Two Hydro-Checks govern the feed rate and serve to balance the hy-



draulic reaction during the feed portion of the stroke. These may be set by means of adjusting lock nuts to control

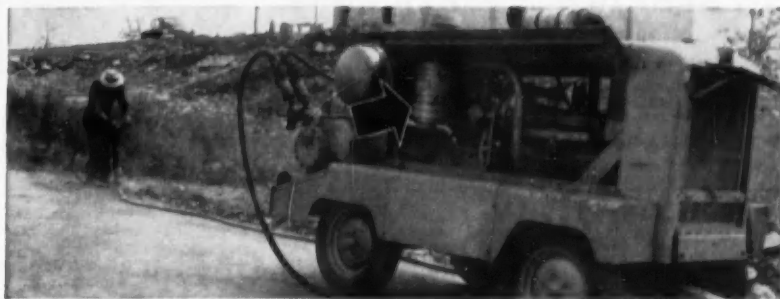
the feed through the entire stroke; or to "rapid traverse," then slow rate of speed at any predetermined point. Skip and stop checking is optional with either electrical or pneumatic controls.

*Circle 28 on reply card*

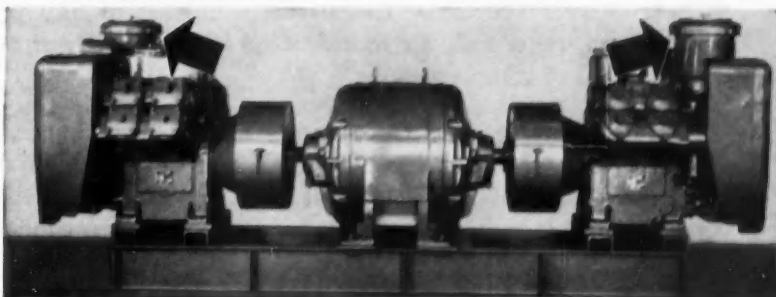
To help facilitate readings and ease worker eye comfort in plant areas where massive machinery shuts off natural or other overhead lights, Sheffield Corporation has illuminated five of its series of 1- to 5-column Precisionaire pneumatic gauging units. Lights have

## Whether you break ground or production bottlenecks

*Air-Maze filters will keep your compressors on the go!*



**Breaks Ground** for highway repair. This calls for dirt-free air to protect precision parts of portable tools and compressor cylinders against premature wearing and scoring. So to assure operating dependability, cut downtime and engine overhaul, contractors rely on Air-Maze filters to scrub dirt-laden intake air completely clean in a bath of oil.



**Breaks Production Bottlenecks.** This manufacturer insures continuous, trouble-free operation of automatic production machinery by using only filtered air in control systems. Erratic operation and production breakdowns are avoided because Air-Maze oil bath filters keep airborne dirt from close fitting pistons, valves and control components.

## AIR-MAZE The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS • LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

25000 Miles Road • Cleveland 28, Ohio

*Circle 21A on reply card*





**BEARIUM METAL** superiority proved in over 25 years of "on-the-job" service in scores of varied applications.

Wherever there is a bearing application involving high speeds, poor lubrication, heat-generating loads, elevated temperatures, dusty and gritty surroundings—or where a liquid other than oil is used as a lubricant—there you will find the ideal application for **BEARIUM METAL**. For it is under adverse operating conditions such as these that **BEARIUM METAL** out-performs all other types of bearing materials . . . by prolonging bearing life, preventing shaft seizure and scoring. In short, it does a more efficient job longer at lower operating cost.

We'll be glad to send you the complete story on **BEARIUM METAL**, so write **TODAY!**

## BEARIUM METALS CORP.

191 Mill St., Rochester 14, N. Y.

**WEST COAST AFFILIATE:**  
Nevin Engineering Associates  
208 Toyopa Drive  
Pacific Palisades, California

**IN CANADA:**  
Bearium Metals of Canada, Ltd.  
155 George St.  
Toronto 2, Canada

Circle 22A on reply card



## Look to **COOK** for Better PACKING RINGS!

Whatever your packing-ring requirements, you can depend on Cook for a ring design and ring material that will deliver maximum efficiency at minimum cost.

One source, one high standard of quality—that's what you get when you specify Cook—packing-ring pioneers since 1888. Write direct for complete technical data. C. Lee Cook Company, 930 So. 8th St., Louisville 8, Ky.

### MATERIALS

#### GRAPHITIC IRON

(Exclusive with Cook)

#### COOKMET

(No. 1—Plastic Bronze)  
(No. 2—Semi-Plastic Bronze)  
(No. 3—Alloy Bronze)

#### BABBITT

(Highly Anti-Frictional)

#### COOKROC

(Laminated Babelite; Standard, Hi-Temp and Graphitized)

#### CARBON

(For Non-Lubricated Service)

**C. LEE COOK**  
COMPANY

Sealing Pressures Since 1888

Circle 23A on reply card

# THE TOOL-OM-ETER

Compressed Air Meter shows direct on a scale, in cubic feet of free air per minute, the flow of air in a pipe or hose. These meters will show the air consumption of any pneumatic tool, rock drill, air motor, sand blast, air-lift, or other application of compressed air.

They are also used for maintaining air equipment in most effective working condition. You can get the facts about your use of compressed air, and these facts will enable you to bring your costs and production under profitable control. Write for new Bulletin A-8.

WE SPECIALIZE in compressed air devices, including the "DriAir" Separator for automatically removing the water from compressed air lines. Ask for Bulletin DA.

**New Jersey Meter Co.**  
Plainfield, N. J.





also been applied to a new model, Mi-cronaire, an air gauge used to test cotton fiber fineness.

Circle 3E on reply card

Non-slip coating (NSC), a product of Walton-March, is a chemical compound of durable plastic resins and polymerized oils having suspended in it aluminum oxide granules. It is capable of being sprayed or brushed, as well as rolled on quickly and easily to eliminate costly accidents and painful injuries caused by slippery footing. There is no need for troweling or special preparation. The gripping surfaces of the granules give traction even under oil or grease. The manufacturer reports that NSC is fire retardant, having resisted temperatures to 2000°F without flaming. The waterproof coating is easily cleaned with ordinary soaps, powders or detergents.

Circle 4E on reply card

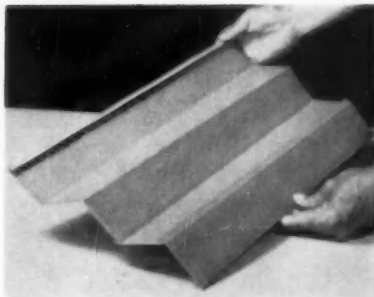
Steam-reactivated dehydrators for drying instrument air and process gas have been announced by Selas Corpora-



tion of America. Available in eleven sizes, handling from 10 to 1000 scfm (air at 70°F, 100 psig) in continuous operation with manual, semiautomatic or automatic cycling, the equipment operates on an 8-hour reactivation cycle, so that manual and semiautomatic models require attention only at the change of shift, assuring regular inspection. Tower inspection and desiccant charging have been simplified, and can be accomplished, it is said, along with other maintenance procedures without disturbing the steam coil.

Circle 5E on reply card

Moisture and suspended contaminants are removed from the air in large industrial plants through the use of a simple flow-through chamber made entirely of rigid vinyl, Geon 8700A, supplied by B. F. Goodrich Chemical Company. This moisture eliminator chamber is the initial unit of an integrated air conditioning system. Its interior consists of many channels formed by deeply cor-



rugated vertical walls. As the air passes through, the corrugations baffle the flow and allow moisture to condense on the smooth surfaced walls. These extrusions reportedly inhibit the buildup of deposits that might eventually interfere with the proper air flow. The interior wall sections, extruded by the Southern Plastics Company, have effectively replaced similar designs made of metal because continuous exposure to moisture and chemical fumes does not damage either their physical properties or appearance. The chamber is easily fabricated and weighs so little that no elaborate supporting structures are required.

Circle 6E on reply card

Piping engineers will be interested in Vic-Easy, a method of quick coupling thin-wall steel and aluminum tubing. It is said to provide positive, leakproof connections. Available for pipe and tubing in sizes ranging from 1 1/4 to 12 inches, the device may be used for working pressures as great as 1000 psi, depending on the wall thickness of the material used. Leading pipe mills are now supplying a wide range of wall thicknesses and weights in steel and aluminum with Vic-Easy rolled grooves,

Two Sure Ways  
to Prevent  
Air Loss



## "AIR KING"

Quick-Acting  
HOSE COUPLINGS



For All Hose Connections

These plain rugged couplings are your surest safeguard against loss of air at the hose connections. Universal locking heads, on sizes up to 1", snap together to form a secure lock that is leak-proof under pressure, in fact, pressure must be released before coupling can be disconnected. Ideal for rough outdoor work as well as indoor shop and plant service. Malleable iron, cadmium plated, and bronze. Hose Ends, Male and Female I.P.T. Ends. Size range, 1/4" to 1". Also available in 4-lug type, not universal, in 1 1/4" to 2" sizes.



"BOSS"  
Self-Honing  
AIR VALVES

For the Entire  
System

The most efficient and economical valves for all valve stations on the system—automatically, permanently leakproof—no packing to wear out and replace—straight-line, full-flow opening through body and plug. Self-adjusting bronze plug automatically hones itself against harder steel or malleable iron valve body, maintaining a perfect leakproof seat. Proper spring tension assures constant sealing adjustment. Strong, durable construction, with handle attached to plug within the valve body. Male or female thread both ends, in sizes 1/4" to 1 1/2".

Stocked by Manufacturers and Distributors  
of Industrial Rubber Products

**DIXON**  
Valve & Coupling Co.  
GENERAL OFFICES & FACTORY—PHILADELPHIA 22, PA.  
BRANCHES—CHICAGO - BIRMINGHAM - LOS ANGELES - HOUSTON  
DIXON VALVE & COUPLING CO. LTD., TORONTO Associate Companies  
Buck Steel Company Inc., Quakertown Pa. - Franklin Street Steel Company London E.C.1.

Circle 25A on reply card

(353)

Adv. 25

# **"Used many makes of turbines... PREFERS COPPUS"**

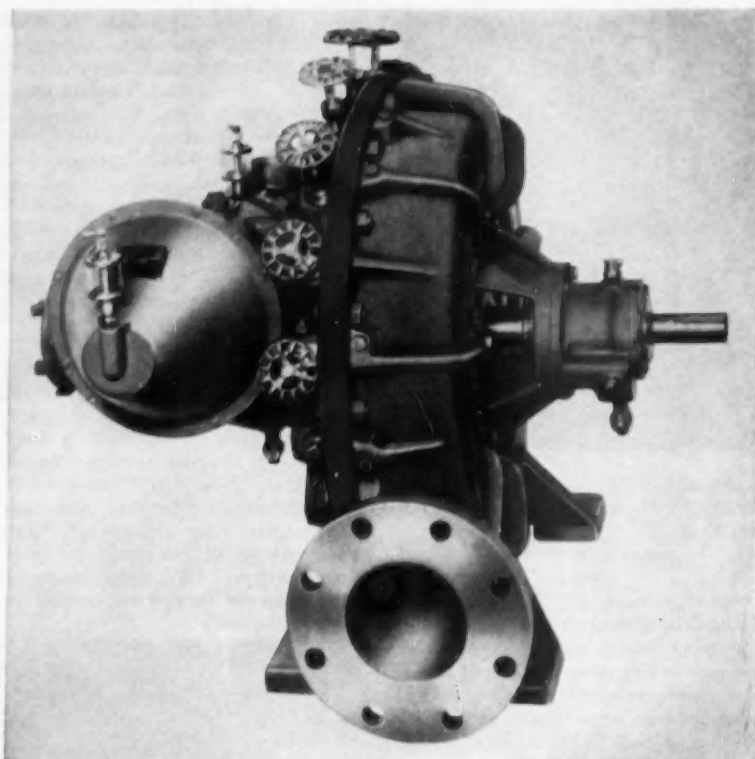
If you want to know about turbine performance, ask an operator. He knows. And, in the words of one of them:

"I have had occasion in the past to operate many makes of turbines. The plant in which I am now employed is almost entirely Coppus equipped on our auxiliary equipment. I find your turbines most satisfactory and would like to congratulate you on your design."

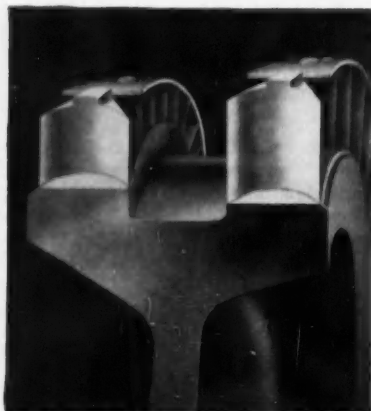
Whether you use a Coppus with a regular wheel or wide bucket "L" type you get these proven features:

- Turbines rated close to your hp requirements from 150 hp down to fractional. No need to buy a bigger, costlier turbine than your conditions call for.
- A larger number of steam nozzles, controlled individually by manually operated valves.
- Exclusive pilot operated excess speed safety trip supplementing constant speed governor.
- Replaceable cartridge type bearing housings.
- Optional carbon ring packing glands.
- Coppus Steam Turbines ranging from 150 hp down to fractional in 6 frame sizes, *make turbine dollars go farther*. Send for Bulletin 135 on Coppus Turbine.

COPPUS ENGINEERING CORPORATION  
211 Park Avenue, Worcester 2, Mass.  
Sales offices in THOMAS' REGISTER



*This is the reliable Coppus Turbine furnished with either a regular wheel or wide bucket "L" type wheel.*

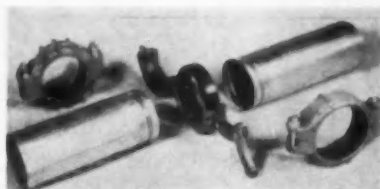


*This wide bucket "L" type wheel is a new development for use where low water rate is essential*



*This is the regular wheel used on Coppus Turbines which have been so highly satisfactory throughout industry.*

# **COPPUS "BLUE RIBBON" TURBINES**



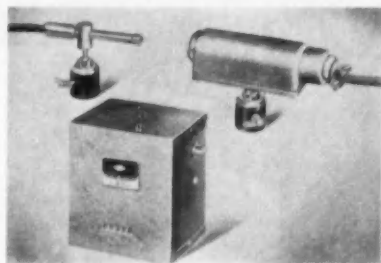
under licensing arrangements with Vic-taulic Company of America, the manu-facturer. It is reported that there is no loss of metal in the rolling process, and the pipe or tubing thus adapted is as sound structurally as when it was first manufactured.

Circle 7E on reply card

Only 10 seconds are said to be required to apply deep-anodized, self-bonding metal nameplates manufactured by W. H. Brady Company. Quik-Plates, as they are called, have a permanent pressure-sensitive adhesive (PermaBond) that requires no activation by water, solvent or heat. Merely removing a Blue Streak Release Liner makes them ready for application. Made from 0.004-inch aluminum, each label will adhere to metal, glass, plastic, wood, painted, smooth, curved, flat or wrinkled sur-faces. The self-bonding nameplates re-quire no holes, pins, screws or other similar fasteners, and therefore are time-savers on the production line. They are used to identify, instruct and inform; for trademarks, insignia, warranties, diagrams, schematics, or wherever perma-nent information is needed on a prod-uct. The nameplates are available in many colors, in both glossy and matte finishes.

Circle 8E on reply card

Robot-Eye is the name of Standard Instrument Corporation's recently de-signed photoelectric control. A cad-mium sulphide cell is used because of its long service life. The components are miniature in size, yet reportedly have high standards of dependability and sensitivity. They can be fastened in small places, and because the light and



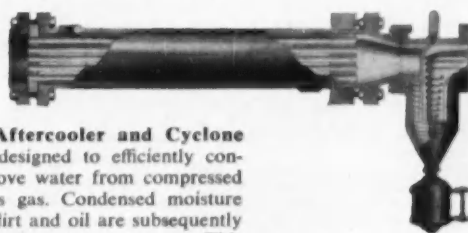
cell unit are mounted on swivels, are easily aligned. The unit will follow operations up to 600 per minute and can operate from either a direct beam, a reflection from the object being con-trolled, or from a mirror reflection.

Circle 9E on reply card

## Aftercooler and Cyclone Separator designed for cleaner, dryer compressed air

R. P. ADAMS CO., INC.

209 East Park Drive, Buffalo 17, New York



The Adams Aftercooler and Cyclone Separator are designed to efficiently con-dense and remove water from compressed air and process gas. Condensed moisture and entrained dirt and oil are subsequently removed in a cyclone type separator. This unit is scientifically designed for maximum removal efficiency over a wide range of flow rates.

For normal use, units are available to cool gases to within 10° F of the temperature of the cooling water. Specially designed units are available to permit a 2° F approach to cooling water temperature, for application where low moisture content is critical.

Adams Aftercoolers and Separators are available from stock to handle 20 - 40,000 cfm with 10° cooling and 25 - 19,200 cfm

where it is necessary to cool within 2° F of the cooling water. Special units can be supplied to suit an unlimited range of requirements. In all cases the maximum pressure loss at rated capacities is 1/2 psi.

This wide range of sizes enables the eco-nomical utilization of Adams Aftercoolers and Separators in virtually all industrial application. For further information on how R. P. Adams' units will solve your com-pressed air problems and save you money, write today for Bulletin 711.

Circle 27A on reply card

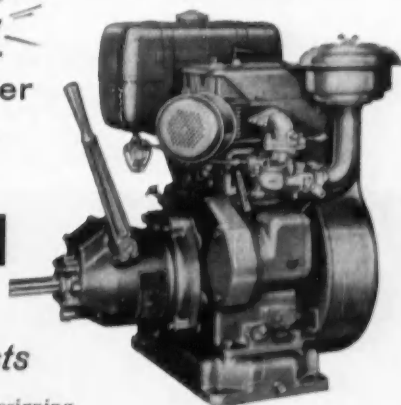
a **BIG** NEW  
4-cycle, single cylinder  
air-cooled engine

the

**WISCONSIN**

**12½ hp Model AGN**

...by Engine Specialists



Model AGN Engine with Clutch As-sembly. Also available with stub shaft or with Reduction, Clutch Reduction and/or Electric Starting.

Backed by an exclusive engine designing and production background dating from 1909, plus today's most advanced engi-neering knowledge and technique, this new engine is destined to become another BIG winner!

Putting 12½ hp. into a single cylinder air-cooled engine calls for basic High Torque ... the load-holding Lugging Power that keeps the equipment working through sudden shock loads. It also calls for heavy-duty construc-tion in all details ... plus dependable cooling under all weather conditions from sub-zero to 140° F.

Bulletin S-216, just off the press, will give you details about the Model AGN. Write for it.



**WISCONSIN MOTOR CORPORATION**

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN

A7-6134-1/2 A2

Circle 28A on reply card



## CELLULUBES ASSURE...

### THE SAFETY OF FIRE RESISTANCE

#### No Flashback

\*Auto ignition point, °F.... over 1150

Hot manifold, mod., °F., Min.... 1350-1370

Molten metal, 1500°F.... no ignition

### THE SAFETY OF EXCELLENT LUBRICITY

†Shell 4-ball wear test (on Cellulube 300)

Wear scar diameter in mm. at 1 Kg load—0.15

Wear scar diameter in mm. at 40 Kg load—0.55

### THE SAFETY OF AN UNCHANGING OPERATIONAL VISCOSITY

You get all these important advantages with Celanese Cellulubes—fire resistance, excellent lubricity, non-corrosive characteristics, and chemical stability. Economy-wise, you get long service life and reclaimability, which permits the fluid's use over and over again. Your Celanese representative will be glad to fill in all details, offer you important assistance in selecting the right Cellulube for the job from the wide range of viscosities available.

\*Fire-resistant properties of Cellulube 90, 150, 220.

†Test conditions: time, one hour; speed, 600 RPM; temperature, 167°F.; contracting surfaces, steel on steel (SKF grade 1).

Celanese® Cellulube®

**ADD  
MORE SAFETY  
TO YOUR  
HYDRAULIC POWER  
WITH**

**FIRE-RESISTANT CELANESE CELLULUBES**



Celanese Corporation of America, Chemical Division,  
Dept. 596-K, 180 Madison Avenue, New York 16, N. Y.

In Canada: Canadian Chemical Co., Limited, 2035 Guy Street, Montreal, P. Q.  
Export Sales: Amcel Co., Inc., and Pan Amcel Co., Inc.,  
180 Madison Avenue, New York 16, N. Y.

## BRIEFS

Interprovincial Pipe Line Company of Canada has opened a 156-mile extension that moves oil eastward from Sarnia to Toronto, Ont. The entire line, reputedly the world's longest, extends 1931 miles from Edmonton, Alb., to Toronto. Originally the system was only complete to Lake Superior where oil was shipped to the east by steamers. Since the Great Lakes are closed to navigation 5 to 6 months each year, the extension was planned and built. Along the completed route, the line is tapped at several places to supply refineries. Thus it serves a large part of Canada's oil needs.

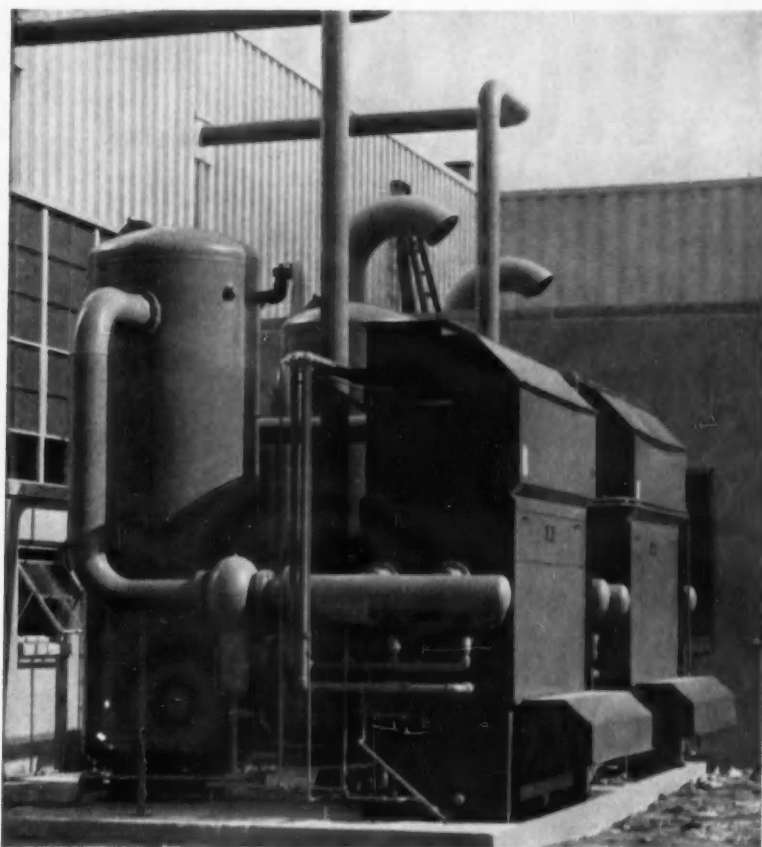
National Steel & Shipbuilding Corporation of California has been awarded a contract to build a hydrographic surveying ship. It is estimated that the 292-foot-long vessel will cost about \$6 million.

Perhaps the world's greatest number of hydroelectric power stations are located in the tiny country of Switzerland. Although there are 6000 of them, they cannot provide enough power to meet the demand during the winter months. In 1956 alone, the stations delivered nearly 14 billion kwh for public consumption. The greatest drain on the supply comes from the Swiss transportation system—3140 miles of electrified railways—and from an estimated 11,000 factories. The next station to be constructed will be Goschenalp Dam. When completed, it will add another 320 million kwh to the country's supply.

Only two radiation deaths have been reported in the United States' atomic industry in 2,500,000 man-hours, as compared to 300 for the same number of man-hours in the average American industry in 1955, according to R. O. Schemerhorn, of General Electric Company.

France's iron-mining industry plans to increase its iron-ore production by 35 percent over the next 5-year period. It is expected that the new goal will be met, for in the past, it has had a steady improvement record. For example, the output per worker per day is now 75-percent higher than it was in 1938, in spite of the intervening war years.

Bingham, Utah, will be the site of the longest single-line mine tunnel in the United States. The bore was started last year by Kennecott Copper Company, will be 3½ miles long, and is expected to be completed by 1960.



*This Niagara Aero After Cooler also cools compressor jacket and intercooler water.*

## COMPRESSED AIR...Lower in Cost Dependably Drier and Cooler Trustworthy for Instrument Use

THE NIAGARA AERO AFTER COOLER offers a completely self-contained method replacing both shell-and-tube cooler and cooling tower. It is independent of a large supply of cooling water and consistently reduces compressed air temperatures to below ambient. Its drier air gives you a better operation and lower costs in the use of all air-operated automatic instruments, tools and machines, paint spraying, sand blasting and moisture-free air cleaning.

Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler in less than two years. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter, proven in service on the largest plant utility air systems.

*Write for complete information; ask for Bulletin No. 130*

## NIAGARA BLOWER COMPANY

*Over 35 Years of Service in Industrial Air Engineering*

**Dept. 6A-11, 405 Lexington Ave.**

**New York 17, N. Y.**

*District Engineers in Principal Cities*

# VICTAULIC®

## METHOD OF PIPING

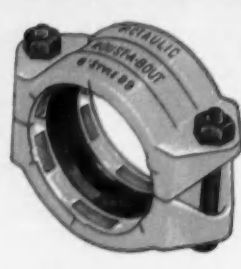


**VICTAULIC HAS EVERYTHING...**



### VICTAULIC COUPLINGS

Simple, fast, reliable. Styles 77, 77-D, for standard uses with steel or spiral pipe, — Style 75 for light duty. Other styles for cast iron, plastic and other pipes. Sizes  $\frac{3}{4}$ " to 60".



### ROUST-A-BOUT COUPLINGS

For plain or beveled end pipe Style 99. Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 12".



### VICTAULIC SNAP-JOINTS

The new, boltless, speed coupling, Style 78. Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

**COUPLINGS FOR EVERY PIPING JOB**



### VICTAULIC FULL-FLOW FITTINGS

Elbows, Tees, Reducers, Laterals, a complete line—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes  $\frac{3}{4}$ " to 12".



### VIC-GROOVER TOOLS

Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes  $\frac{3}{4}$ " to 8".

**PLUS FITTINGS AND GROOVING TOOLS**

**"EASIEST WAY TO MAKE ENDS MEET"**

Promptly available from distributor stocks coast to coast.

Write for NEW Victaulic Catalog-Manual No. B-11

**VICTAULIC COMPANY OF AMERICA**  
P. O. BOX 509 • Elizabeth, N. J.

Circle 31A on reply card

### Industrial Literature

Vidigage, an ultrasonic resonance instrument used for fast, nondestructive testing, is described in Technical Bulletin No. V-200, available from Branson Instruments, Inc. Complete data on the time-saving advantages of using the instrument to measure thickness of metal, glass and plastic from one side, and to find corrosion, laminar discontinuities, or other flaws are given. An accessory section describes not only a recently developed converter for use in automatic sorting, high- and low-limit alarms, automatic acceptance and rejection, continuous recording and similar control methods, but transducers and extra-length cables as well.

Circle 10E on reply card

Two pages describing a line of aluminum foil wire markers is available from North Shore Nameplate, Inc. The precut material is said to resist not only temperatures to 350°F, but soil, grease and water; to fit and stick to any wire diameter; to be protected by transparent coating against rubbing and abrasion; and to require no tools. Although any size, shape, color or symbols can be specified, a large stock of items in solid or consecutive numbers, letters, symbols and machine-tool symbols, as well as symbols repeated in sequence is available for immediate delivery.

Circle 11E on reply card

A 24-page American Standard booklet that establishes definite classifications for surface roughness, waviness and lay was recently issued by the American Society of Mechanical Engineers, and is available from Brush Electronics Company. It defines geometric irregularities of solid material surfaces and physical specimens for gauging roughness. To assure a uniform basis for measurement, specifications are also provided for both precision reference and roughness comparison specimens, and tracer-type instruments.

Circle 12E on reply card

Transducers for remote indication, measurement and control of pressure in industrial process and flight control applications are being offered by H. E. Sostman & Company. The complete line is detailed in a recently published 3-page data sheet.

Circle 13E on reply card

Automation in materials handling and the working of metals is the subject of *Automation in Practice*, by S. E. Rusinoff, professor of mechanical engineering at Illinois Institute of Technology. The volume explains the use of automatic controls and pneumatic, hydraulic, electrical and electronic control devices.

It further shows how automation may be used in production of metals, metal casting, pressworking, metal-cutting operations, heat-treatment of metals, testing, inspection and quality control.

Circle 14E on reply card

*Gage Laboratory Instruments*, published by the Sheffield Corporation, features instruction, specifications and a layout guide explaining how individual manufacturing plants may organize their own individual gage laboratories to meet requirements for closer and more convenient control of part-measurement standards. It represents a guide to close control of precision measurement as an integral part of plant-wide quality control and describes the work and the services of Sheffield's new Eli Whitney Metrology Laboratory, illustrating and explaining the functions of the newest Sheffield Accutron electronic amplifier and gauging instruments.

Circle 15E on reply card

Multimet is an alloy that has been developed by Haynes Stellite Company, a division of Union Carbide & Carbon Corporation. Its chemical properties and such data as rupture strength, fatigue and creep are described in a 24-page booklet. A special section tells about methods used for welding, forming and machining the alloy. In both the wrought and cast form, Multimet has been used successfully in aircraft and metal working applications, and is recommended for high-stress uses at temperatures up to 1500°F, and for moderate stresses at up to 2000°F.

Circle 16E on reply card

Mass spectrometer leak detector, Type M-2, is covered in a 12-page bulletin published by General Electric Company. Explanations of its operating principles and diagrammatical descriptions of five methods of leak detection are given. A special section describes maintenance information and includes street addresses of the company's service shops.

Circle 17E on reply card

A diversified line of hose reels for industrial use is the subject of a 16-page catalogue published by Clifford B. Hannay & Son, Inc. Standard units described include hose reels for efficient handling of liquids and gases, cable reels, and ones for storage of rope and wire.

Circle 18E on reply card

*Hoffco-veyer Systems*, Brochure No. PN-500 that describes the U. S. Hoffman Machinery Corporation's systems for pneumatic conveying of dry, free-flowing materials, discusses basic types of equipment that are available, successful installations in operation and gives a complete survey of installation applications.

Circle 19E on reply card

## Teamed for DEPENDABILITY



BLAW-KNOX MODEL 85 ROAD WIDENER  
AT WORK NEAR KNOXVILLE, TENNESSEE.  
POWER: CONTINENTAL RED SEAL.

## ... two Famous Names: Continental and Blaw-Knox

Like so many other leading builders of construction machinery, Blaw-Knox offers its customers the tangible PLUS-value of Continental power. Continental engineers each power plant to the specialized requirements of its job, for highest dependability, longest trouble-free life.

WORLD'S LEADING INDEPENDENT MANUFACTURER  
OF INTERNAL COMBUSTION ENGINES, CONTINENTAL  
MOTORS OPERATES PLANTS IN ATLANTA, DALLAS, DETROIT,  
MILWAUKEE, MUSKEGON, AND TOLEDO, AND IN ST. THOMAS,  
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ENGINES FOR USE ON LAND, AT SEA AND IN THE AIR.

### *Continental Motors Corporation*

MUSKEGON • MICHIGAN

FACTORY-AUTHORIZED SERVICE AND GENUINE  
RED SEAL PARTS ARE AVAILABLE EVERYWHERE

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## WIRE ROPE AT WORK

Nello L. Teer, of Durham, N. C., has handled many tough contracts, but the one near Aliquippa, Pa., probably topped them all. This project called for the widening of Constitution Boulevard along the east bank of the Ohio River. Teer's contract, covering 2.51 miles, required some prodigious digging. An estimated 3,000,000 cu yd of rock and dirt was removed from the shale and sand-

stone cliffs that bordered the roadway.

While breaking the rock from the face of the cliffs, the Teer shovels frequently worked at close quarters on very narrow benches. Though it was rugged going, the schedule permitted no delays. To assure top performance of critical boom and hoist lines, Bethlehem wire rope was chosen for these assignments, and easily met every demand imposed upon it. Bethlehem rope is a natural for this kind of work, being so tough and strong that it takes the heaviest loads in stride.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

CONSTRUCTION • EXCAVATING • MINING • QUARRYING • PETROLEUM • LOGGING • MANUFACTURING





Typical of K-30 application is this two-piece sealing ring design with K-30 outer ring and cast iron or stainless steel inner.

## Licks tough ring problems

### Proven Applications

- ★ Non-Lubricated Compressors: air, nitrogen, oxygen, hydrogen and carbon dioxide.
- ★ Rotary Shaft Seals: corrosive and non-corrosive surface.
- ★ Miscellaneous: sealing rings wearing directly against aluminum cylinders, wear bushings, wear inserts, and plug-type pistons.

### Wide Range of Sizes and Types

Koppers K-30 piston, wear and sealing rings may be made in all widths and diameters—for use with cast iron, stainless steel, aluminum or chromium-plated cylinders.

Radical, rugged Koppers K-30 gives you new operating economy and long-lived performance in applications too tough for ordinary piston and sealing ring materials. K-30, a special compound of TEFLON\* with other wear-resisting materials, features:

- ★ *Low friction coefficient*—inhibits ring wear.
- ★ *Self-lubrication*—reduces cylinder wear.
- ★ *Zero water absorption*—means that it cannot swell or change its shape.
- ★ *Temperature resistance*—from a molecular structure that permits operation at temperatures from -350° F. to 500° F.
- ★ *Toughness and flexibility*—eliminate breakage, scoring and other damage caused by storing, handling, installing or servicing. Permit smaller ring cross-sections and smaller piston sizes and weights.
- ★ *Chemical inertness*—makes K-30 corrosion-proof.

If you have a ring problem, put Koppers to work on it. Contact your nearest Koppers Representative or write KOPPERS COMPANY, INC., Piston Ring and Seal Dept., 1611 Scott St., Baltimore 3, Md.

\*TEFLON—trademark of E. I. DuPont de Nemours & Co. for tetrafluoroethylene resin.



## INDUSTRIAL PISTON AND SEALING RINGS

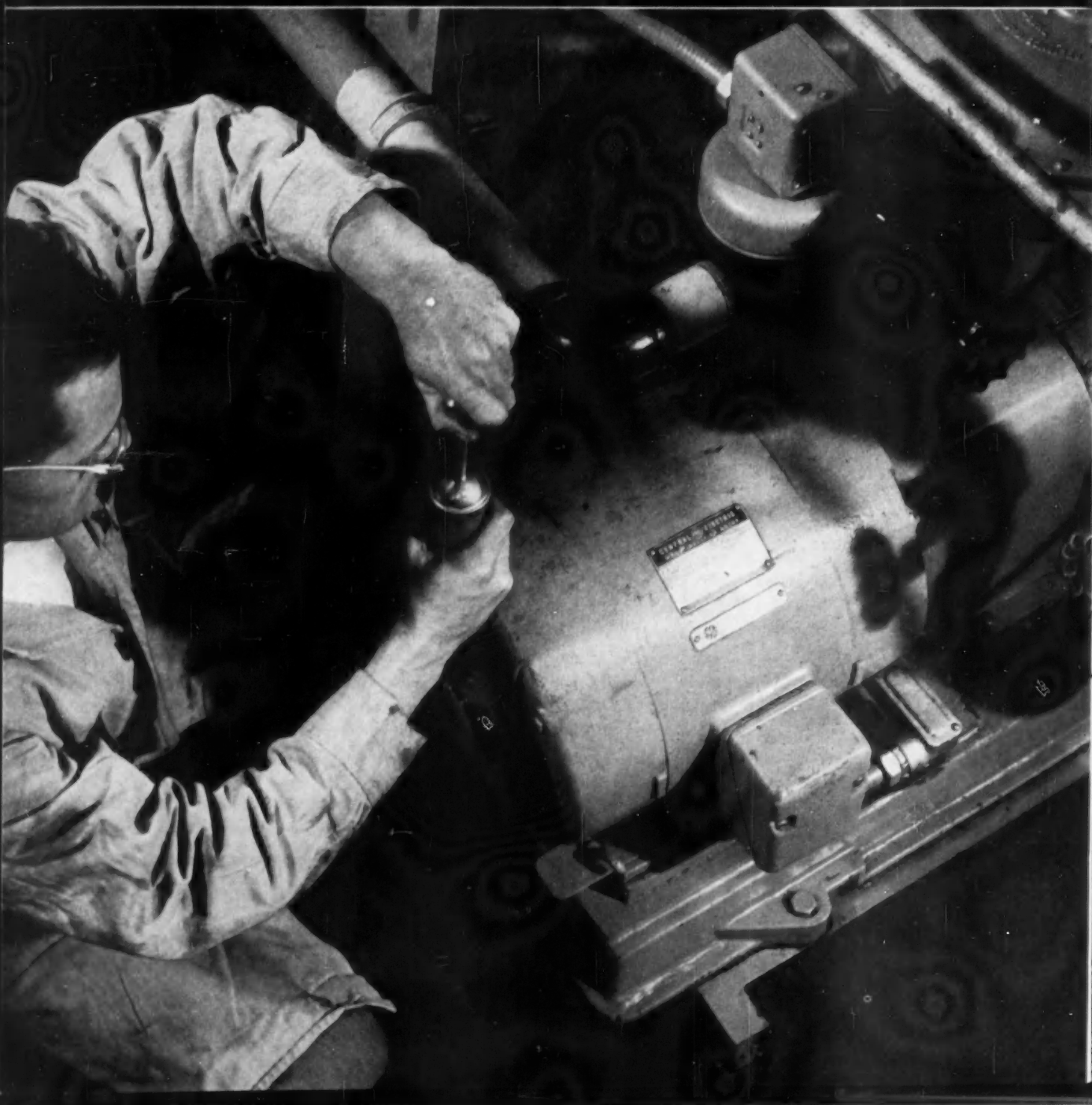
Engineered Products Sold with Service

**compact . . . power-packed**

**New General Electric**

# **NOW EASIER**

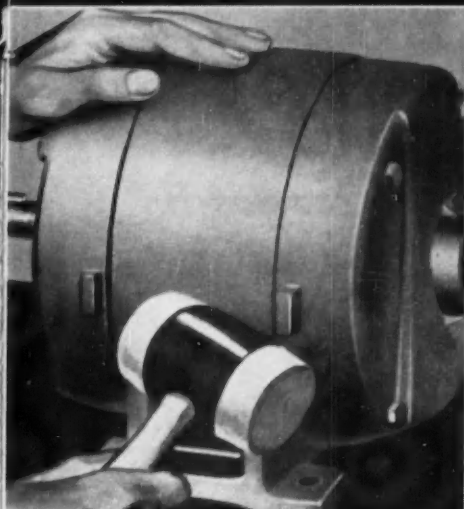
**COMPLETE LINE AVAILABLE**



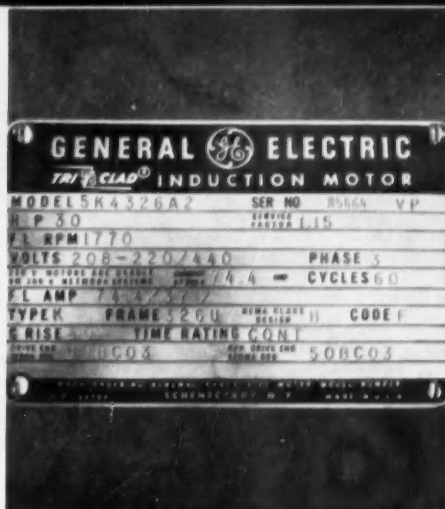
**TRI 55 CLAD Motors are...**

# TO MAINTAIN

**THROUGH 125-HORSEPOWER**



**FAST END-SHIELD REMOVAL** is possible because of Tri-Clad '55' motor's rugged knock-off lugs. Remove four bolts, tap on knock-off lugs and end-shield is off to permit easy repositioning or quick motor inspection.



**EASIER TO MAINTAIN**, Tri-Clad '55' motors utilize a stainless-steel, non-corrosive nameplate to give complete rating information including AFMB bearing numbers. Separate steel plate gives connection diagrams.



**EASIER TO INSTALL**, Tri-Clad '55' motors use Perma-numbered leads to simplify wiring, speed motor hook-up. Numbers are stamped on terminals and printed on every half-inch of Geoprene<sup>®</sup> leads.

## immediate shipment... all ratings

The need for faster production schedules and reduced production costs has made motor maintenance of prime concern to motor users. Modern motors must be easy to inspect and maintain without loss of production time due to routine maintenance.

**TO MEET THIS NEED**, G-E Tri-Clad '55' motors feature an oversize grease reservoir which contains enough grease for normal 5-year operation. Yet, new grease can be added while the motor is running. Other easy maintenance features are described above.

**EASE OF MAINTENANCE**, however, is not the whole Tri-Clad '55' motor story. Experienced G-E motor engineers have used revolutionary materials and the most modern production and testing facilities to provide a motor that is not only easier to maintain, but also more reliable and easier to install.

Formerly available only to 30-hp, these proven Tri-Clad '55' motors are now available for immediate shipment—usually from nearby warehouse stocks—up through 125-hp.

**FOR FULL INFORMATION** on the complete Tri-Clad '55' motor line contact your nearest G-E Apparatus Sales Office or Distributor.

Section K891-7  
**GENERAL ELECTRIC COMPANY**  
Schenectady 5, New York

Please send me the following publications:

- ☐ **FREE BULLETIN (GEA-6602)** describes advanced features of new Tri-Clad '55' motors through 125-hp.
- ☐ **FREE SLIDE RULE (GEN-148)** to determine weight and space-saving benefits of new Tri-Clad '55' motors.

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

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*Progress Is Our Most Important Product*

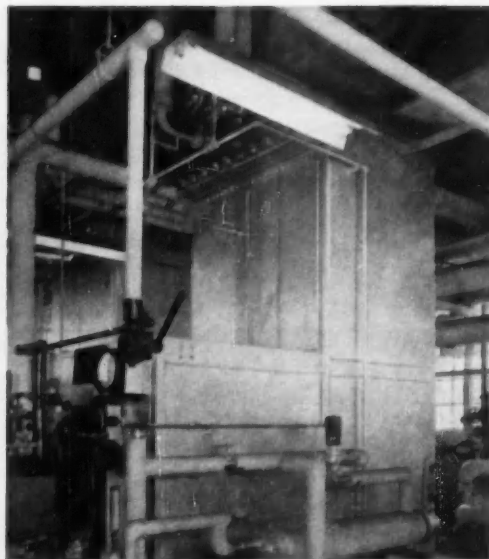
**GENERAL  ELECTRIC**



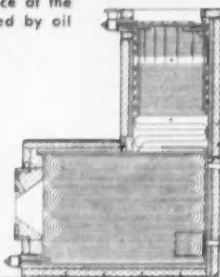
# *The Cross Company specifies . . .* **High temperature water by C-E for heating economy ...low maintenance**

The Cross Company, pioneer producer of automation machinery, has recently completed an ultra-modern plant in Fraser, Michigan — practically doubling its former production capacity. After a thorough study of heating requirements . . . and with a view toward further expansion . . . two C-E LaMont Controlled Circulation Hot Water Boilers were specified for the new plant. According to Mr. W. P. Reece, Plant Engineer, "the study indicated that this system would provide the lowest fuel and maintenance costs . . . Experience during this winter confirms the soundness of our decision."

If you are in the market for a heating or process system, it will pay you, too, to investigate high temperature water. Individual needs vary, of course, and both hot water and steam boilers have their place. Our engineers will be pleased to discuss the subject with you or your consultants. Write for our catalog HCC-2.



C-E HT Water Boilers in service at the Cross Company. They are fired by oil or natural gas.



Right — One of the 12 million Btu/hr Cross Company boilers. C-E HT Water Boilers are available in sizes from 10- to 300 million Btu per hour; pressures to 500 psi and temperatures to 470F.



Architect's drawing of the new Cross Company plant, Giffels and Vallet, Detroit, Consulting Engineers; Owen S. Lieberg, Associated Consultant.

## **THESE ARE THE GENERAL ADVANTAGES OF HIGH TEMPERATURE WATER:**

1. Higher available heat — many times that of steam at the same pressure.
2. Closer control of temperature.
3. Lower heat loss . . . unused heat returns to the boiler . . . no condensate return lines.
4. No elaborate feedwater treatment . . . make-up requirements are exceptionally low.
5. Steam traps not required . . . trap problems and expense are eliminated.
6. No blowdown losses . . . no safety valve vent losses . . . no condensate losses.

## **THESE ARE THE SPECIFIC ADVANTAGES OF THE C-E "HT" WATER BOILER:**

1. Complete control over circulation in both system and boiler.
2. No separate boiler pump is required, since low pressure loss is inherent.
3. Pressurized operation with oil or gas means no induced draft fan.
4. Single-pass design — no baffles — means cleaner boiler and lower draft loss.
5. Controlled, positive circulation permits more efficient arrangement of heating surfaces.
6. Any fuel — oil, gas, coal, or any combination of fuels.
7. Gastight, welded, steel casing.
8. Fewer headers, all of which are easily accessible.

## **COMBUSTION ENGINEERING**

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

CANADA: COMBUSTION ENGINEERING-SUPERHEATER LTD.



ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE



*This job called for speed!*

## **GYRO-FLO 85** saves time as contractor changes underground tanks at 40 gas stations

Sunoco's new variable octane gasoline required new underground storage tanks at the forty service stations in the vicinity of Newburgh, N.Y. Contractor Ira D. Conklin and Sons was told that each installation had to be *fast*. None of the stations could be shut down during the work... gasoline trucks were actually standing by to fill the new tanks as they were lowered into their excavations.

Since it was necessary to make fast moves with men and equipment from station to station on heavily-traveled streets, the contractor used the highly-portable Gyro-Flo 85 as his primary source of air power. This portable—the only rotary built in the 85-cfm size—provided air for diggers and

paving breakers during excavation.

At one station heavy rainstorms caused flooding of an excavation that had already been prepared. A hurry-up call was put through for the Gyro-Flo 85 working at a station some distance away. The compressor was rushed to the scene, hooked up to an I-R sump pump, and dewatering was accomplished while the tank was being lowered into its excavation.

Meeting tight deadlines is a Gyro-Flo habit: the lightweight model 85 matches the larger Gyro-Flo models (up to 900-cfm) in the essential element of dependability under the most demanding job conditions. Ask your I-R distributor for details or write for form 2307.

# Ingersoll-Rand

11 Broadway, New York 4, N. Y.

**CONTRACTORS'  
COMBINATION**



2-643

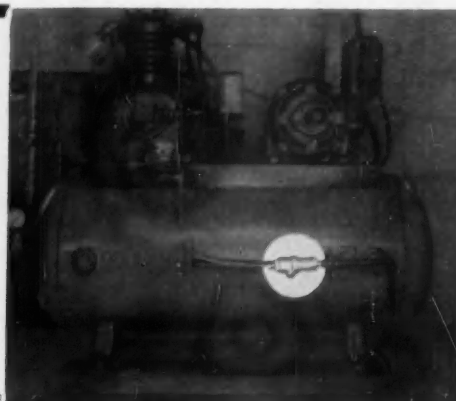
**AN UNBEATABLE COMBINATION... GYRO-FLO COMPRESSORS AND I-R ROCK DRILLS**

if you OPERATE AIR COMPRESSORS  
you should know that  
**HAND DRAINAGE is NOT ENOUGH**

Do it automatically . . . GEORGE EJECTORS drain the tank every time the governor or unloader operates. Simple construction . . . only two moving parts . . . with nylon spindle that outwears brass 5 times. Specify the GEORGE EJECTOR on your next compressor purchase.

write today for free literature

**GEORGE** MANUFACTURING CO.  
10-16 Harvey Street, Philadelphia 44, Pa.



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**LOW COST**  
**Preventive**  
**Maintenance**

For Pipe, Pipe Joints,  
Fittings, Couplings,  
Tanks, etc.



Use **TAPECOAT**®

...the Quality Coal Tar Coating in Handy Tape Form

To combat corrosion on underground pipe lines, you need the best possible protection at lowest possible cost. Since 1941, TAPECOAT has proved its superiority in resisting moisture, acids, alkalis, chemical fumes, electrolysis, soil stress, salt water and other severe corrosive and abrasive conditions. TAPECOAT is self-bonding, easy to apply spirally with the use of a torch. Requires no skilled help. Cuts maintenance and replacement costs. Comes in rolls of 2", 3", 4", 6", 18" and 24" widths.

Write for brochure and prices

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Sales and Service Offices in Principal Cities

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**HEAVY DUTY**  
**PRESSURE**  
**SWITCH**  
FOR AIR  
COMPRESSORS

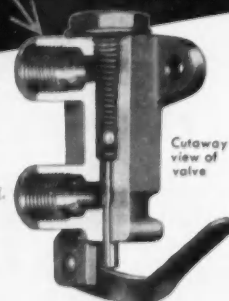


Class 9013  
Type ASG  
Form X

**COMPLETE RANGE IN**  
**1 CONTROL UNIT**

Either 20 to 180 or 25 to 250 PSI.  
No spring changes required.

**MORE AIR CAPACITY**  
with improved 2-way ball  
and "O" ring type valve.



Cutaway  
view of  
valve

Write for Bulletin 9013A. Address Square D Company,  
4041 N. Richards Street, Milwaukee 12, Wisconsin



NOW...E&M PRODUCTS ARE A PART OF THE SQUARE D LINE

**SQUARE D COMPANY**

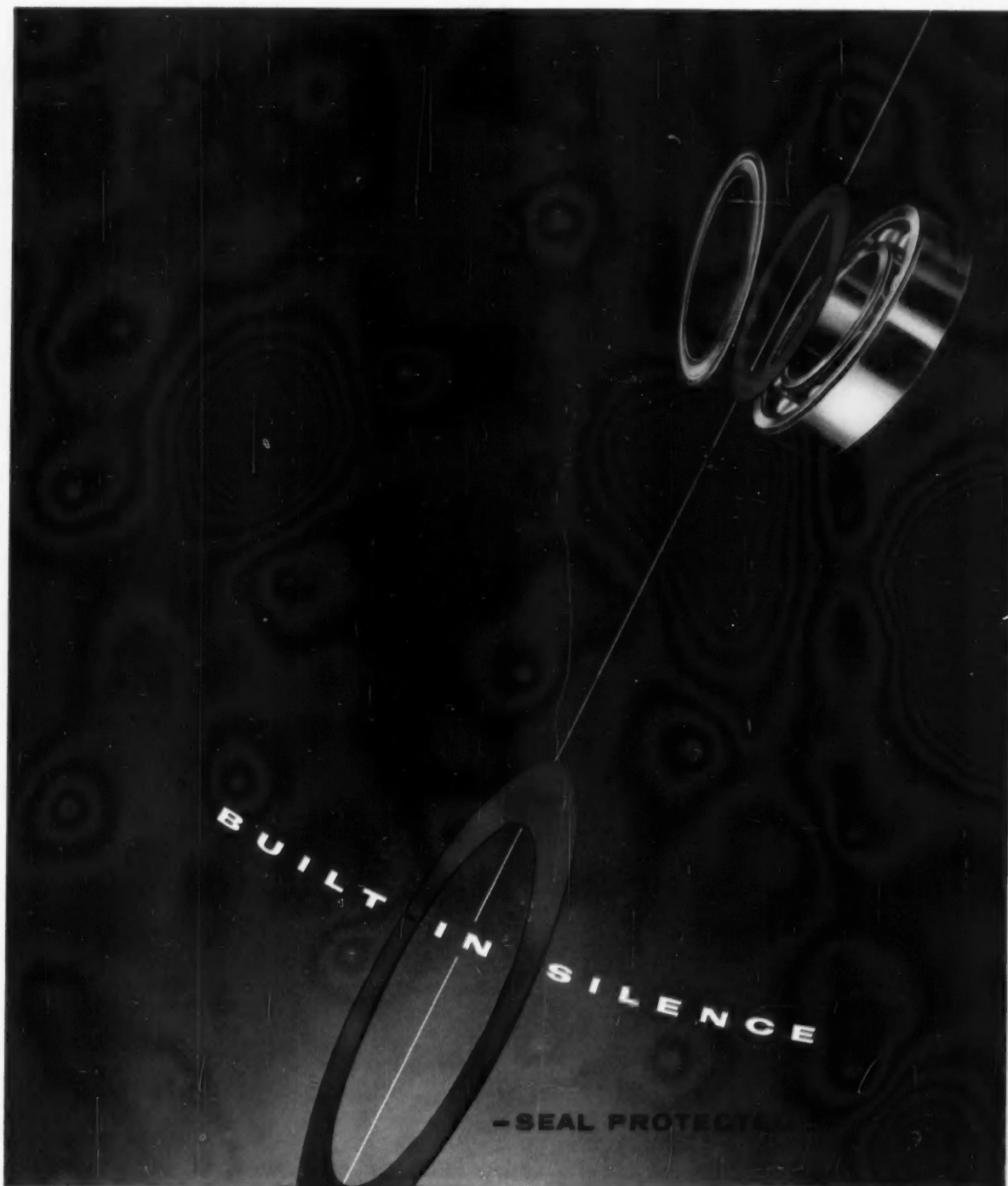
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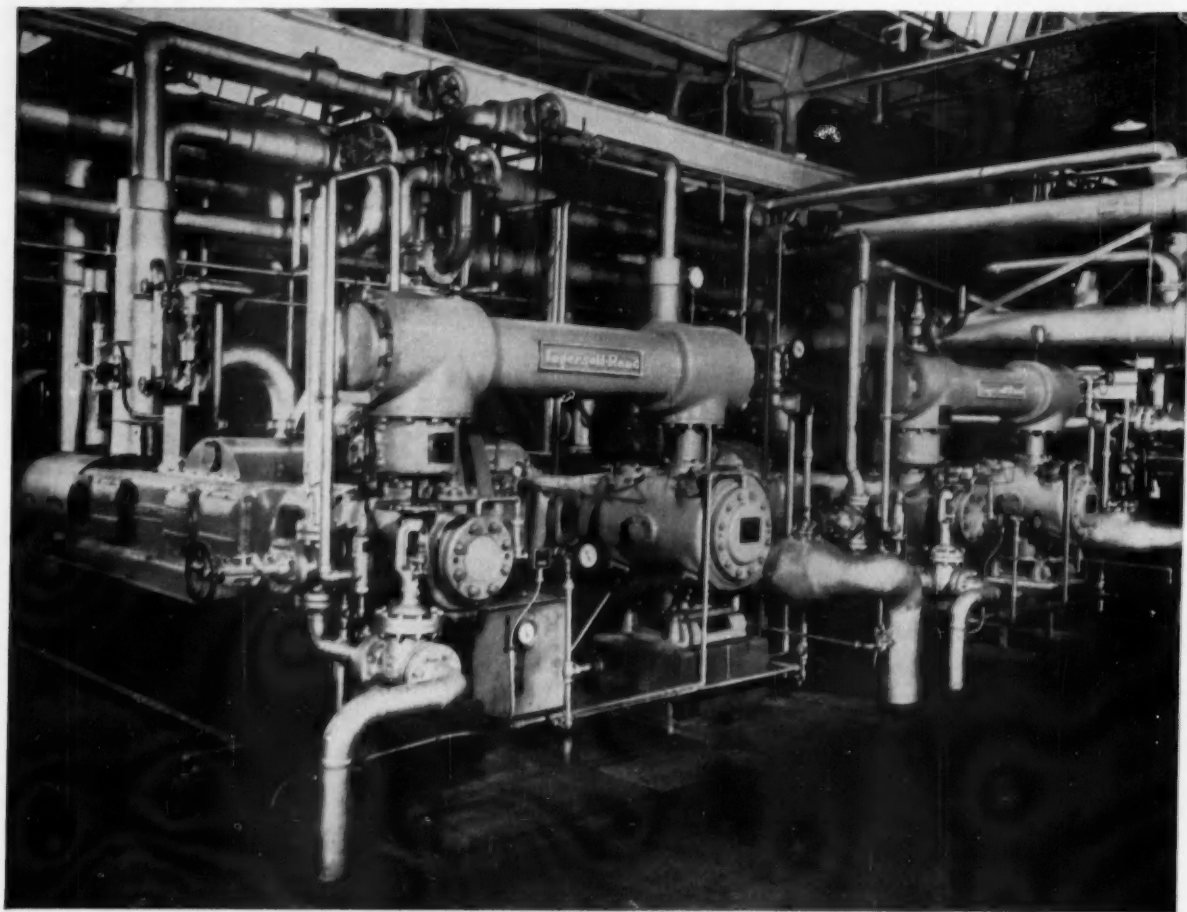
\* Reg. U.S. Pat. Off.

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

*The most silent rolling contact bearing in the world of today*

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## key to reliable air power

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*Texaco Regal Oils R & O* keep air compressors operating at full efficiency year after year. Here's how:

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